MERTARVIK
HOUSING MASTER PLAN

Prepared for:
The Newtok Village Council
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AVCP Regional Housing Authority
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January 13, 2017

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Above: Advancing erosion at the Newtok village site.

Above: The Mertarvik Site in September, 2015
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The Cold Climate Housing Research Center has been tasked by the Newtok Village Council to complete a Housing Master Plan for the village of Mertarvik. This is to include a report on the housing needs of the community along with a roadmap for relocating. CCHRC has been deeply committed to assisting the people of Newtok for a number of years. We feel very fortunate to play a role in their effort to relocate to Mertarvik due to the eminent threat caused by erosion.

The following report contains an in-depth analysis of the community’s housing needs, background on the relocation effort, strategies for developing phased housing and infrastructure at the new site, specific housing designs, and funding opportunities.

With the speed and severity of erosion at Newtok, we recognize the urgency of relocating and have recommended strategies to allow pioneer families to live at the new village before final infrastructure is in place, including self-sufficient power, water, and waste systems. In each case, affordability was a driving factor in designing these systems.

The community of Newtok faces a unique opportunity to build homes and infrastructure that are cost-effective and appropriate for the region. The designs included in this report are examples specific for the climate, environment, and remote location of Newtok, and emphasize energy efficiency and healthy indoor air quality. As Alaska communities are forced to adapt to a changing climate, Newtok will be an inspiration to other villages facing many of the same problems.

All of us at the Cold Climate Housing Research Center are committed to assisting the Newtok Village Council in any way we can. We are confident that the rich and vital culture, centuries of successful adaptation in the region, and deep commitment to finding solutions will lead to success. We look forward to the celebration of the day a Sustainable Northern Community is realized at Mertarvik.

Sincerely,

Paul Charles
President
Newtok Village Council

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Sincerely,

Paul Charles
President
Newtok Village Council
<table>
<thead>
<tr>
<th>ACRONYMS</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAHA</td>
<td>Alaska Association of Housing Authorities</td>
</tr>
<tr>
<td>ACS</td>
<td>Alaska Community Survey</td>
</tr>
<tr>
<td>AEA</td>
<td>Alaska Energy Authority</td>
</tr>
<tr>
<td>AHFC</td>
<td>Alaska Housing Finance Corporation</td>
</tr>
<tr>
<td>ANTHC</td>
<td>Alaska Native Tribal Health Consortium</td>
</tr>
<tr>
<td>ARIS</td>
<td>Alaska Retrofit Information System</td>
</tr>
<tr>
<td>AVCP RHA</td>
<td>Association of Village Council Presidents - Regional Housing Authority</td>
</tr>
<tr>
<td>BEES</td>
<td>Building Energy Efficiency Standard</td>
</tr>
<tr>
<td>BIA</td>
<td>Bureau of Indian Affairs</td>
</tr>
<tr>
<td>CCHRC</td>
<td>Cold Climate Housing Research Center</td>
</tr>
<tr>
<td>CDP</td>
<td>Census Designated Place</td>
</tr>
<tr>
<td>DCRA</td>
<td>Alaska Division of Community and Regional Affairs</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>HIP</td>
<td>Housing Improvement Program</td>
</tr>
<tr>
<td>HUD</td>
<td>Housing and Urban Development</td>
</tr>
<tr>
<td>IHBG</td>
<td>Indian Housing Block Program</td>
</tr>
<tr>
<td>MEC</td>
<td>Mertarvik Evacuation Center</td>
</tr>
<tr>
<td>NAHASDA</td>
<td>Native American Housing Assistance and Self Determination Act</td>
</tr>
<tr>
<td>NPG</td>
<td>Newtok Planning Group</td>
</tr>
<tr>
<td>NTC</td>
<td>Newtok Traditional Council</td>
</tr>
<tr>
<td>NVC</td>
<td>Newtok Village Council</td>
</tr>
<tr>
<td>ONAP</td>
<td>Office of Native American Programs (part of the Housing and Urban Development)</td>
</tr>
<tr>
<td>SIP</td>
<td>Structural Insulated Panel</td>
</tr>
<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
</tr>
<tr>
<td>USDA RD</td>
<td>United States Department of Agriculture Rural Development</td>
</tr>
</tbody>
</table>
Executive Summary

In 2016, the Association of Village Council Presidents Regional Housing Authority (AVCP RHA), at the request of the Newtok Village Council (NVC), requested technical assistance in the development of a Surface Affordable Housing Master Plan for the planning and development of permanent affordable housing at the new village site, known as Mertarvik. The plan addresses the short-term and long-term housing and infrastructure needs of Mertarvik. It will also address the overcrowded issues of the current village site and the need for additional housing for young families, who left the village due to lack of housing, but want to return to the village.

A recent housing stock assessment in Newtok found that 12 of the 78 existing houses are in an acceptable condition to be relocated. The remaining 66 units are not in a condition to be relocated, nor would any amount of rehabilitation make them relocatable. CCHRC completed a housing Needs Assessment and concluded that at least 105 new housing units will be needed at the Mertarvik site to meet the current housing needs. Other estimates that include planning for growth are up to 131 units. Even the moving the 12 homes that are liveable would be logistically challenging if not impossible; they may need to be replaced instead. Based on this assessment, there will be a critical housing shortage at the new village site.

Newtok is eroding at an advanced rate, and the community cannot afford to wait for a fully constructed village to be finished before moving over. It is much more likely that people will need to move to the new community in stages, and that homes constructed in Mertarvik will need to operate without the benefit of community-wide infrastructure. These “Pioneer Families” should have wraparound services that provide electricity, clean water, safe disposal of human waste, and reliable heat, handled at the level of the individual home. As infrastructure comes online, these “Pioneer” dwellings will need to be able to plug in to that infrastructure.

This Master Plan addresses the need for a phased approach to housing and services at multiple scales, focusing on both the design standards of the individual home and the collaboration with agencies on community-wide infrastructure. It also addresses the very real possibility that a disaster will develop at the old community site before the new community site is fully inhabited, and provides guidance on how to plan disaster-relief housing in such a way that it can meet permanent housing needs for the community.

CCHRC has a deep commitment to the people of Newtok that began in 2008. CCHRC staff are familiar with members of the Village Council, AVCP Regional Housing Authority, the Newtok Planning Group, and the DOWL Project Management team; and have worked hard to foster a relationship of mutual trust and respect. When invited by these groups, we have provided assistance in the realms of both housing and public buildings. As a 501c3 nonprofit entity, our mission has been to provide housing guidance to Alaska communities in a climate where financial resources are increasingly scarce and must be used for the maximum benefit of the community. In these challenging times, all Alaskans must work together to address the economic and climatic realities that make relocation efforts so complex and difficult. Toward this end, we wish to emphasize that in order for the relocation effort to succeed, a holistic approach involving the varying expertise of Tribal Leaders, Regional Housing Authorities, State Agencies, and public and private industry will need to be implemented, so that each partner is able to offer up the services that they are most suited to contribute.
Project Description

The Mertarvik Housing Master Plan consists of the following key components:

**Housing Development Need:**
The CCHRC team traveled to Newtok to perform a Housing Needs Assessment to be used as a primary planning tool in the Housing Master Plan. Drawing on prior needs assessments, and with the goal of both updating housing needs in Newtok and using that need specifically to plan the housing strategy in Mertarvik, the Housing Needs Assessment addresses overcrowding, family preferences, options for rent and ownership, special needs, and other factors to give the most detailed picture of the current housing shortage in the existing community of Newtok, so that this data may be used to create appropriate housing at the new site of Mertarvik.

**Housing Design:**
In order for the residents of Newtok and the Newtok Village Council to effectively make decisions on what type of housing they would like to see developed in Mertarvik, CCHRC decided to include multiple designs that could be used as a reference when Council members needed to convey their desires and needs to any contractor that could potentially build homes in Mertarvik. CCHRC has included in this report, three house designs that are developed to 100% with included construction documents and three house designs that are developed to 15% that focus on needs expressed by the community during CCHRC's site visits. The different types of housing included are the Demonstration House, the Octagon “Quinhagak” House, the “Hawk” Starter Home, an Extended Family Duplex with Universal Design Principles, a larger home with a loft for Multi-generational families, and a Transitional Modular House Design that could be built quickly, if disaster occurs before enough housing has been developed.

**Infrastructure Needs:**
Initially, it is anticipated that homes should be self-sufficient through incorporating decentralized water/sewer and electrical systems. This plan describes an approach, and examples, of how self-sufficient and decentralized systems can work. The project addresses how new houses can be constructed and retrofitted for centralized water/sewer and electrical systems in the future. Community-wide infrastructure will be designed and planned by other agencies, so the housing master plan will need to be adaptable and cognizant of how housing can best fit in with these concurrent plans.

**Site Control:**
CCHRC staff coordinated with entities completing subdivision planning, surveying, platting and recording including the phasing of roads, infrastructure systems, and housing development during the site control process.

**Funding Sources:**
The plan incorporates an in-depth discussion of potential funding sources that can be utilized to leverage for the housing development and infrastructure needs. These include State, Federal, and other funding sources.

**Plan sets and other resources:**
100% Construction Documents for: Demonstration Prototype Home, Octagonal “Quinhagak” House, Spenard Builders Supply-CCHRC “Hawk” 20FT x 20FT Starter Home
REMOTE Wall description and wall section
BrHEAThe v2.0 combined Heat and Ventilation System Diagram and overview
PASS Water and Wastewater Diagram and explanation
Project Partners

The following is an alphabetical list of project partners and their roles in the relocation of the village of Newtok to Mertarvik as of the publication of this report. Partners and roles are subject to change throughout the process of relocation.

**Association of Alaska Housing Authorities**
AAHA is a nonprofit membership agency that includes fourteen regional housing authorities and the Alaska Housing Finance Corporation. AAHA’s mission is to increase the supply of safe, sanitary, and affordable housing and community development in Alaska. It provides legislative advocacy, development, funding information and technical assistance. This report was funded through a HUD Technical Assistance Grant administered through AAHA.

**Alaska Energy Authority**
The Alaska Energy Authority (AEA) is an independent corporation of the State of Alaska and the State’s energy office whose mission is to reduce the cost of energy in Alaska. AEA is under contract to Denali Commission to provide a master energy plan, power plant design, and bulk fuel system. The Housing Master Plan will coordinate closely with AEA’s Energy Plan to ensure that the new housing is staged to be compatible with the development of small-scale and large-scale power distribution infrastructure.

**Alaska Native Tribal Health Consortium**
ANTHC provides health services for Alaska Native people at the Alaska Native Medical Center in Anchorage and across the state through training, education, disease and injury prevention, and rural water and sewer construction. ANTHC is providing geotechnical investigation and topographical surveys of the site, design of a washeteria, design of a water distribution and wastewater collection system, landfill design, and village layout.

**Association of Village Council Presidents Regional Housing Authority**
AVCP-RHA is the state chartered regional housing authority for the Yukon-Kuskokwim Delta region of Alaska. The housing authority provides affordable housing opportunities and services to program-eligible individuals and families. The programs include homeownership, rentals, rental vouchers, housing services, housing management, modernization, renovation, crime prevention and administration and planning, and construction of new housing, modernization and weatherization of homes using the force-account method of construction. In Mertarvik, AVCP-RHA will be assisting with funding and will also be building new homes.

**Cold Climate Housing Research Center**
CCHRC is an industry-based, nonprofit corporation created to facilitate the development, use, and testing of energy efficient, durable, healthy, and cost-effective building technologies for people living in circumpolar regions around the globe. Involved in Newtok since 2008, CCHRC created the original design for the Mertarvik Evacuation Center and designed a prototype home that was built in Mertarvik in the summer of 2016. CCHRC is the primary author of this report and will be involved in Mertarvik in a Technical Advisory role, assisting with the design and construction of energy efficient, durable, and culturally appropriate structures.

**Denali Commission**
The Denali Commission is an independent federal agency designed to provide critical utilities, infrastructure, and economic support throughout Alaska. The Denali Commission is focused on increasing inter-agency cooperation in Alaska’s remote communities. The Denali Commission is funding much of the current relocation planning.
DOWL Engineering
DOWL is a multi-disciplined consulting firm owned by senior managers from within the company, providing civil engineering and related services for more than 50 years. DOWL maintains in-house expertise in Environmental and Land Development, Water/Water Resources, Transportation, Civil Engineering and Geo-Construction. DOWL has been hired by the Newtok Village Council and the Denali Commission as lead project manager for planning and construction in Mertarvik. DOWL is coordinating the Newtok Design and Construction Group.

Goldstream Engineering
Goldstream Engineering specializes in on-site water and wastewater system design for residential and commercial facilities. The company’s experience and expertise also includes civil engineering projects such as site grading and drainage plans, parking lots, roads, small airports, community water and wastewater design and treatment systems, regulatory permitting, environmental services, and construction management. Goldstream Engineering is designing the roads and coordinating development of the gravel quarry and road building.

Newtok Village Council
The Newtok Village Council is the village leadership body and federally recognized tribal government.

Newtok Traditional Council
The NTC is the former village leadership and worked closely with CCHRC on the original design for the Mertarvik Evacuation Center. The NTC initiated the relocation process in 1994. Tribal government duties were officially transferred to the NVC in 2015.

Newtok Planning Group
The Newtok Planning Group was formed in May 2006 when representatives from state and federal agencies and non-governmental organizations began meeting with Newtok to coordinate assistance in the relocation of the community to a new village site on Nelson Island. The NPG has convened regularly since its formation, working with Newtok and across agencies to leverage resources, secure funding, and to establish a framework and strategy for moving the relocation process forward. A list of all participants in the NPG is in the appendix of this report.
Background

Newtok is a traditional Yup’ik Eskimo community of approximately 350 people located on the Ninglik River in Western Alaska. Progressive coastal erosion from ocean storm surges and degrading permafrost have created an untenable threat to the community. Multiple erosion studies concluded that there is no cost-effective way to halt this process, and that the people of Newtok must relocate to a new site. In 2006, the community began actively searching for solutions to the challenges posed by village-wide relocation.

Working with state and federal agencies, private contractors, and tribal entities, the community has made incremental progress toward relocating. The community selected a site for the new village, called Mertarvik, nine miles south of the current village across Baird Inlet. The Mertarvik site has sufficient elevation to protect the community from erosion and violent fall storms, and has appropriate land for a gravel quarry, an airstrip, public buildings, and housing. The new site also has an existing source of fresh water that has been used for generations by people in the region. Mertarvik is a Yup’ik word that translates roughly to “Getting water from the spring.”

Housing has been called the single limiting factor to the Newtok community moving to Mertarvik. (Newtok Planning Group Website, 2015). At least 66 households exist in the current village, and the population is young and growing quickly. A 2014 structural survey of homes at the existing village concluded that the vast majority are in poor condition and do not have the structural integrity to survive a move.

The Newtok Planning Group’s website lists the following progress to date on housing at the new site, consisting of seven homes:

- The first three homes were acquired through Bureau of Indian Affairs (BIA) Housing Improvement Program (HIP) grants in 2006 and constructed in 2007.
- In 2011, Newtok received grants for three additional homes through the Association of Village Council Presidents (AVCP) Regional Housing Authority through HUD’s Native American Housing Assistance and Self Determination Act (NAHASDA) Program. The community decided to purchase Structural Insulated Panel (SIP) home packages. Members of the community received training on constructing with SIP panels and homes were built over the summer of 2012.
- The seventh home is a prototype house designed by the Cold Climate Housing Research Center (CCHRC), funded by a BIA HIP grant. The prototype house is both extremely energy efficient and moveable. The house has a skiddable foundation and can be towed across the ice or tundra when needed. It contains a small water-treatment plant and a generator, which can be used before public utilities are available at the new site. Construction of the prototype was completed over a seven-week period in summer 2016, using CCHRC instructors and a local crew.
Left and Below: These pictures were taken during a flyover of the Mertarvik site in 2014, after the IRT had finished its exercises. By 2014, the Mertarvik site had a barge landing, construction staging area, Bivouac Site, gravel storage, MEC Foundation, six homes, four sheds/storage buildings, and temporary road materials (Durabase) stockpiled.
Left: Army Corp developed this graphic of estimated erosion of the shoreline at Newtok every five years. So far, the actual erosion has been in alignment with these estimates.
Below: A timeline developed by The Newtok Planning Group showing activities toward the relocation effort from 2006-2016.
Above: Barges delivering at the shallow barge landing site lay anchor at high tide and then wait for low tide to rest on the shore.

Above: Transport back and forth from Mertarvik to Newtok can only take place at high tide. Local skiffs are inaccessible at low tides.

Above: The deep barge landing at tide change.

Above: At high tide the boats are accessible at the deep barge landing site, but the lack of dock makes loading heavy materials challenging.

Above: Looking toward the low tide barge landing from the high tide barge landing at mid-tide.
Above: A view of the trail from the village to the site and the gravel quarry.

Above: The gravel quarry was originally developed by the IRT team.

Above: A view of the blasting and grading site above Mertarvik.

Above: The gravel quarry site viewed from the north.

Above: The Durabase road from the MEC site, looking downhill toward the staging area and barge landing.

Above: A significant amount of Durabase road material has been stockpiled at the staging area, along with steel dowells and cap pieces for assembly.
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The Cold Climate Housing Research Center (CCHRC) conducted a housing needs assessment on behalf of the Newtok Village Council to document the housing conditions in Newtok, Alaska and estimate the housing needs for the community’s move to Mertarvik. CCHRC performed the housing assessment via interviews of community members in May 2016. This chapter contains the results of the survey. It also includes the procedure used for the housing assessment and results from past housing assessments done in Newtok.

The purpose of the housing needs assessment, stated in the Technical Assistance Grant administered by the Alaska Association of Housing Authorities (AHAA), is as follows:

“The housing needs assessment will include an assessment of overall need, as well as look into housing typologies that can address extended-family models and address overcrowded housing models. CCHRC will report the assessment results to AVCP RHA, ONAP, the Newtok Tribal Leadership, and the Newtok Planning Group.”

Mertarvik Housing Needs

CCHRC staff asked households how many homes they would need once the community moved to Mertarvik in order to identify how overcrowded households in Newtok would like to live in the future. Some families wanted to remain in one house but increase the number of bedrooms, while others preferred to split up into different homes.

In 55 surveys, a total of 34 households indicated they would like to remain in one house; 11 households preferred to split into two houses; and 10 preferred to live in three houses. This indicates a total of 86 houses will be needed in Mertarvik.

However, there are two additional considerations.

Eleven households did not or could not be surveyed. Thus, at least an additional 11 houses will be needed, increasing the total to 97 houses.

Then, people who were surveyed identified an additional 8 families who would like to move back to Newtok or Mertarvik and require housing. In that case, the total would be 105 houses.

Home Characteristics

Interviewees also identified characteristics that they desired for homes in Mertarvik. As seen in the first row in Table 1, residents all chose to live in a single family home detached from other houses. No interviewees chose the apartment-style option that was presented in the survey. Elders were offered additional options (see the questions in Appendix C) that addressed if they would like to live with a caretaker.
Table 1: Description of homes needed in Mertarvik

<table>
<thead>
<tr>
<th>Type of home</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional single family home detached from other houses. This number includes some elders wishing to live in their own house</td>
<td>82</td>
</tr>
<tr>
<td>Traditional single family home for an elder living with a caretaker</td>
<td>2</td>
</tr>
<tr>
<td>Traditional single family home for an elder living with their relatives</td>
<td>2</td>
</tr>
<tr>
<td>Total 86</td>
<td></td>
</tr>
</tbody>
</table>

| Number of bedrooms | 1 bedroom - 6  |
|                    | 2 bedrooms - 21|
|                    | 3 bedrooms - 25|
|                    | 4 bedrooms - 33|
|                    | 5 bedrooms - 1 |

| Number of bathrooms | 1 bathroom - 83 |
|                     | 2 bathrooms - 3 |

<table>
<thead>
<tr>
<th>Number of homes that would need special accommodations for disability access and movement</th>
<th>23</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is 27% of the 86 necessary homes from the surveys.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preferred heating fuels</th>
<th>Fuel oil - 83</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviewees could select more than one, total possible for each fuel is 86</td>
<td>Wood - 76</td>
</tr>
<tr>
<td></td>
<td>Coal - 3</td>
</tr>
<tr>
<td></td>
<td>Electricity - 1</td>
</tr>
<tr>
<td></td>
<td>Wind turbine - 6</td>
</tr>
<tr>
<td></td>
<td>Solar energy - 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preferred plumbing options</th>
<th>Running hot and cold water - 82</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviewees could select more than one, total possible for each option is 86.</td>
<td>Bathroom with toilet - 82</td>
</tr>
<tr>
<td></td>
<td>Bathtub and shower - 82</td>
</tr>
<tr>
<td></td>
<td>Laundry room - 79</td>
</tr>
<tr>
<td></td>
<td>Steamhouse - 64</td>
</tr>
</tbody>
</table>
Home Financing

CCHRC employees asked how interviewees could help pay for new homes in Mertarvik. This question was asked in regards to each potential home in Mertarvik, thus there are more than 55 answers - families wishing to split into more than one home addressed payment for each potential home in Mertarvik. However, some interviewees declined to answer the question, or did not understand it, so the number of responses does not exactly match the number of homes needed in Mertarvik. Loans were presented as an option, as seen in the responses in the table below. However, CCHRC interviewers noted that many people in Newtok understood a loan to be similar to a rent-to-own program and that “yes” responses to using loans do not necessarily indicate willingness or desire to take out a traditional home loan with an interest rate.

The table also includes the average and median monthly household incomes for each group of responses. In cases where a single Newtok household indicated that they would like to move into more than one home in Mertarvik, their monthly income was split equally between each potential new home’s financing option for this analysis.

Table 2: Financing options

<table>
<thead>
<tr>
<th>Financing option</th>
<th>Responses</th>
<th>Percent of the 76 total responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>The family has money to pay for the home upfront, or has already built the home in Mertarvik.</td>
<td>4</td>
<td>5%</td>
</tr>
<tr>
<td>Average household monthly income: $1,718</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median household monthly income: $1,765</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The family PREFERS to rent the home. If this option is not available, they would consider a rent-to-own or loan program.</td>
<td>26</td>
<td>34%</td>
</tr>
<tr>
<td>Average household monthly income: $1,627</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median household monthly income: $794</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household income analyses includes 6 homes reporting zero income.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The family wishes to pay for the home using a rent-to-own program such as Mutual Help, or through a loan.</td>
<td>38</td>
<td>50%</td>
</tr>
<tr>
<td>Average household monthly income: $2,386</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median household monthly income: $1,849</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household income analyses includes 4 homes reporting zero income.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The family wishes to rent the home and does not wish to consider a loan.</td>
<td>8</td>
<td>11%</td>
</tr>
<tr>
<td>Average household monthly income: $650</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median household monthly income: $600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household income analyses includes 4 homes reporting zero income.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Many people in Newtok are willing to participate in the construction of homes in Mertarvik, and would be willing to take construction training if it were available.

Table 3: People willing to help with construction in Mertarvik

| Number of adults willing to participate in home construction in Mertarvik | Paid only - 9  
Volunteer or paid - 112 |
| Number of adults willing to participate in construction training for building homes | Paid only - 12  
Volunteer or paid - 68 |

Newtok Population
CCHRC interviewed 55 households in Newtok during the first week of May, 2016. The team estimated a total of 66 households in Newtok, because there were at least 11 households that were not interviewed: 3 households already had a home in Mertarvik and declined the interview; 3 households were identified as being out of town; and 5 households declined to be interviewed for other reasons. The 55 households that were interviewed represent approximately 83% of the total of 66 households.

All 55 interviewees provided the number of people living in their homes.

Table 4: Household population

| Total number of people in the 55 households | 303 |
| Total number of people in the 55 households, including seasonal occupants | 322 |
| Average number of occupants per house | 5.5 |
| Average number of occupants per house, including seasonal occupants | 5.8 |
| Minimum number of people per house | 0 (represents an individual with no home) |
| Maximum number of people per house | 12 |
| Number of households with someone that requires wheelchair or disability access | 3 |

Interviewers gathered demographic information for each adult in the household, including race, age, and income. The number of responses is indicated, as many interviewees did not know the monthly income of all adults in their household or chose not to answer those questions.
### Table 5: Adult characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Responses</th>
<th>Number of adults responding to question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of adults identified</td>
<td>157</td>
<td>N/A</td>
</tr>
<tr>
<td>Average age</td>
<td>39.3 years</td>
<td>150</td>
</tr>
<tr>
<td>Predominant race</td>
<td>Alaska Native or American Indian - 150</td>
<td>151</td>
</tr>
<tr>
<td></td>
<td>Other - 1</td>
<td></td>
</tr>
<tr>
<td>Corporation</td>
<td>Calista - 125</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>Bristol Bay Native Corporation - 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cook Inlet Region Inc. - 1</td>
<td></td>
</tr>
<tr>
<td>Household monthly income</td>
<td>Average - $2,435</td>
<td>55 surveys</td>
</tr>
<tr>
<td></td>
<td>Median - $1,680</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Range - $0 to $15,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zero income - 11 households</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$1 to $1,000 - 9 households</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$1,001 to $2,000 - 12 households</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$2,001 to $3,000 - 6 households</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$3,001 to $4,000 - 6 households</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$4,001 to $5,000 - 4 households</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Above $5,000 - 7 households</td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td><strong>Full time - 24</strong></td>
<td>151</td>
</tr>
<tr>
<td></td>
<td>Local, state, federal government (includes school) - 21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retail - 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other - 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Part-time - 46</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Local, state, federal government (includes school) - 27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction - 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Service - 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retail - 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other - 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fishery/Cannery - 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Seasonal - 3</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Local, state, federal government (includes school) - 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Construction - 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other - 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Unemployed - 60</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Retired - 16</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Self-employed - 0</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Subsistence - 2</strong></td>
<td></td>
</tr>
<tr>
<td>Other sources of income</td>
<td>Dividends from state, Native Corporation - 129</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td>Public assistance - 34</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retirement/Pension - 6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social security - 24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unemployment - 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Child support - 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interest, estates, or trust income - 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Violent Crime Compensation Board - 1</td>
<td></td>
</tr>
</tbody>
</table>
Newtok Housing Stock
Interviews addressed the homes that are currently occupied in Newtok. The purpose of these questions is to record the condition of the current housing stock and help establish the urgency of the move to Mertarvik. The interviewees documented 54 buildings (one of the 55 interviewees is homeless).

Table 6: Home characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Responses</th>
<th>Number of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Building type</strong></td>
<td>Single family residence - 50</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Duplex - 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mobile home - 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other - 1</td>
<td></td>
</tr>
<tr>
<td><strong>Average size in square feet (residents reported approximate sizes)</strong></td>
<td>563 square feet</td>
<td>45</td>
</tr>
<tr>
<td><strong>Decade built</strong></td>
<td></td>
<td>54</td>
</tr>
<tr>
<td>2010 or later</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2000-2010</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>1990 - 1999</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>1980 - 1989</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Before 1980</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td><strong>Number of separate rooms in the building</strong></td>
<td></td>
<td>53</td>
</tr>
<tr>
<td>1 room</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2 rooms</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>3 rooms</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>4 rooms</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>5 rooms</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>6 rooms</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>7 rooms</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Number of bathrooms in the building</strong> (As Newtok does not have a water/sewer system, “bathroom” in this case means a separate room to place the honey bucket or a basin for washing)</td>
<td></td>
<td>53</td>
</tr>
<tr>
<td>0 bathrooms</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>1 bathroom</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>2 bathrooms</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Homes where living areas other than bedrooms are used as a sleeping area at night</strong></td>
<td>Only bedrooms used - 22</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>Other areas used - 31</td>
<td></td>
</tr>
<tr>
<td><strong>Condition of the building</strong></td>
<td></td>
<td>53</td>
</tr>
<tr>
<td>Good condition</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Needs minor repairs</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Needs major rehabilitation</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td><strong>Buildings with a wheel chair ramp</strong></td>
<td>None</td>
<td>54</td>
</tr>
</tbody>
</table>
Overcrowding

In general, “overcrowding” is a subjective term based on cultural and personal values and varies widely across the globe. This assessment uses the U.S. Department of Housing and Urban Development’s definition of overcrowding where a housing unit is considered “overcrowded” if there is more than one person per room, and severely overcrowded if there are more than 1.5 people per room. In this case, a “room” includes any space separated by a partial or complete wall, including bedrooms, kitchens, living rooms, dining rooms, etc., but not including bathrooms, porches, balconies, foyers, halls, or unfinished basements.

For example, a three-bedroom house with a separate kitchen, dining room, and living room would be considered “overcrowded” if it had seven occupants or more, or “severely overcrowded” if it had 10 occupants or more. This definition was based on research into when overcrowding causes negative health and childhood education impacts for occupants (The United Kingdom Office of the Deputy Minister, 2004) (Econometrica, Inc. et. al., 2007).

Using this definition, the majority of homes surveyed were overcrowded, with most qualifying as “severely overcrowded.” The most overcrowded home actually had 11 occupants per room, more than seven times the

Above: The majority of houses in Newtok are severely overcrowded.

Left: Older homes in Newtok are not raised up on pilings like newer homes from the 1990s and 2000s (right).
number of people that would qualify the home as severely overcrowded.

**Home Features**

Table 7: Home features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Number of homes reporting feature in the 55 surveys</th>
<th>Percent of the 54 homes with the feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>52</td>
<td>96%</td>
</tr>
<tr>
<td>Electric stove or range</td>
<td>46</td>
<td>85%</td>
</tr>
<tr>
<td>Telephone service (includes cell phones)</td>
<td>42</td>
<td>78%</td>
</tr>
<tr>
<td>Refrigerator</td>
<td>37</td>
<td>69%</td>
</tr>
<tr>
<td>Passive ventilation (fresh 80s)</td>
<td>25</td>
<td>46%</td>
</tr>
<tr>
<td>Steamhouse</td>
<td>12</td>
<td>22%</td>
</tr>
<tr>
<td>Sink with a faucet</td>
<td>12</td>
<td>22%</td>
</tr>
<tr>
<td>Mechanical ventilation (bathroom fan)</td>
<td>8</td>
<td>15%</td>
</tr>
<tr>
<td>Gas stove or range</td>
<td>3</td>
<td>6%</td>
</tr>
<tr>
<td>Bathtub or shower</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td>Mechanical ventilation (HRV)</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Hot and cold running water</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Flush toilet</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Interviewees also answered questions about the features of their homes. As one interviewee reported being homeless, the 55 surveys represent 54 homes.

**Need for Repair**

Above: The majority of occupants of houses in Newtok reported that their homes were in need of major rehabilitation.
Problem | Number of homes reporting the problem in the 55 surveys | Percent of the 54 homes with the problem
--- | --- | ---
Broken doors and/or windows | 40 | 74%
Foundation is bad | 39 | 72%
Mold on walls or rotting walls | 36 | 67%
Poor/nonexistent ceiling insulation | 33 | 61%
Insulation in the walls is poor | 32 | 59%
Porch and/or steps need repair | 30 | 56%
Roof leaks/needs repair | 26 | 48%
Electric outlets do not work | 20 | 37%
There are holes in the floor | 19 | 35%
Insulation in the floor is poor | 10 | 19%
Plumbing leaks | 8 | 15%
Frozen pipes in winter | 7 | 13%
Fire/smoke damage | 7 | 13%
Other repairs needed | 7 | 13%

Above: Older homes in Newtok experience a range of problems, including moldy walls, leaky roofs, and broken foundations.

Table 8: Need for home repairs in Newtok
Thirty-seven buildings reported needing major rehabilitation, and another nine reported needing minor repairs. The number and types of problems with the homes are reported in Table 8. As one interviewee reported being homeless, the 55 surveys represent 54 homes.

**Home Financing**

The majority of homes in Newtok are owned by someone in the household without a mortgage or loan. Out of 54 interviewees, 36 reported that the house was owned without a mortgage or loan. Three homes are owned by someone with a mortgage or loan, six homes are rented, five are occupied without payment of rent, and four homes are on a rent-to-own program.

The average rent for homes that are rented or rent-to-own is $243 per month, with payments ranging from $100 to $900 per month. In all cases, rent was paid by members of the household.

No homes, rented or owned, were required to pay real estate taxes or insurance on the property.

**Utilities**

All of the surveyed homes in Newtok use fuel oil or kerosene for heating. An additional 28 homes (52% of the surveyed homes) had a secondary heat source. Of those, 26 use a wood-fired appliance for secondary heat and the remaining 2 homes have electric back-up heat.

The majority of homes surveyed pay for heating fuel (93%) and electricity (94%). These utilities are paid separately from a mortgage or rent payment. Only one home reported having to pay for water. A total of 34 homes reported that they had a subsidy to help pay all or a portion of their utilities.

**Methodology**

Two CCHRC employees conducted the housing survey from April 30 to May 4, 2016. CCHRC planned the trip in coordination with the Newtok Village Council, selecting dates when many families would be present in Newtok because of river ice break-up.

Upon arrival in Newtok, CCHRC and the Newtok Village Council distributed fliers explaining the reason for the survey and how the results would be used. The flier is provided in Appendix B of this document. The CCHRC team conducted interviews in the school and in private homes. Family members and members of the Newtok Village Council helped translate questions for citizens who preferred to answer in Yupik. To ensure that no households
were missed, CCHRC worked from a map of Newtok, accounting for all buildings that had been interviewed. CCHRC collected household names and addresses to prevent duplication of surveys. The majority of interviews, nearly 70%, were conducted with the head of the household; remaining interviews were done by the spouse of the head of household, children, or other relatives.

The team interviewed a total of 55 households, or approximately 83% of the 66 households that the team estimated were in Newtok. There were at least 11 households that were not interviewed: 3 of these already had a home in Mertarvik and declined the interview; 3 households were out of town; and 5 households declined the interview.

To write the interview questions, CCHRC began with interview questions that were included in the 2012 housing assessment conducted by AVCP Regional Housing Authority, which were provided by CEO Mark Charlie. Overall, CCHRC kept the questions similar to allow comparison between the two surveys. However, CCHRC did customize questions for this survey:

In some instances, questions were deleted or consolidated to shorten the survey where possible.

In some instances, questions were added to gather more detail about a topic.

Questions were added about the number, type, and financing of houses to be built Mertarvik.
CCHRC sent the draft survey to review from Romy Cadiente, Relocation Coordinator for the Newtok Village Council; Colleen Dushkin, grant administrator from AHAA; and Mark Charlie, Chief Executive Officer of AVCP RHA. These reviews helped CCHRC revise questions to better align with the community’s goals for the survey. The final survey questions appear in Appendix C.

**Past Housing Needs Assessments**

A variety of previous projects included assessments of the housing in Newtok. Their results are listed below, with the most recent studies listed first.

**Newtok Village Tribal Hazard Management Plan Update–2016**

This section contains information from a Tribal Hazard Management Plan Update (Newtok Village, 2015) and a telephone interview with Newtok Village Council Relocation Coordinator, Romy Cadiente, on March 8, 2016.

**Table 9: Newtok Hazard Mitigation Plan Information**

<table>
<thead>
<tr>
<th>Population</th>
<th>450</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total occupied housing units</td>
<td>70</td>
</tr>
<tr>
<td>Main employers</td>
<td>School, health clinic, Traditional Council, Native Corporation, commercial fishing</td>
</tr>
<tr>
<td>Electricity</td>
<td>Ungusraq Power Company</td>
</tr>
<tr>
<td>Water</td>
<td>It is pumped from a nearby lake into a water treatment plant and transferred to the Village water tank. Residents then haul water from watering points in the village, collect rainwater in the summer, and thaw ice in the winter.</td>
</tr>
<tr>
<td>Wastewater</td>
<td>Honey buckets are used to dump waste along the Newtok River bank. There is no plumbing.</td>
</tr>
</tbody>
</table>

Above: Aerial map of Newtok (Newtok Village, 2015)
The document’s main goal is to describe the hazard mitigation plan for Newtok, including the planning process, the hazards and vulnerabilities in the area, and the mitigation goals. However, it also included a description of the community and documented the residences currently in Newtok. Information specific to Newtok is found in the table below.

The Hazard Mitigation Plan Update also contains a map of the village and a list of all Newtok facilities and residences in the appendices. The list is accompanied by a photo of each structure with its GPS coordinates and estimated value. The estimates came from the survey question: “How much would it cost to replace the structure if it was destroyed?”

**2013 Alaska Housing Assessment, Bethel Census Area**

The 2013 Alaska Housing Assessment (Wiltse, et. Al.) compiled housing data by region and community. The data

<table>
<thead>
<tr>
<th><strong>2010 Population (Census data)</strong></th>
<th>354</th>
</tr>
</thead>
</table>
| **Housing occupancy (mix of data sources)** | Owner-occupied: 49  
Rent-occupied: 23  
Vacant, recreational: 2  
Other vacant: 2  
Total: 76 |
| **Housing units by decade built (ACS data)** | 1950s: 3  
1960s: 4  
1970s: 15  
1980s: 24  
1990s: 21  
2000-2011: 8  
Total: 75 |
| **Overcrowded housing units (ACS data)** | Severely overcrowded: 45  
Overcrowded: 21  
Occupied, not overcrowded: 15  
Total: 81 |
| **Housing units completing an AHFC retrofit program, such as BEES, Home Energy Rebate Program, or Weatherization** | None |
| **Median annual household income** | $40,000 |
in the housing assessment was gathered from Alaska Community Surveys (ACS), the United State Census, and ARIS, a database of energy audits done on residences in Alaska. In the case of Newtok, there was no ARIS data available, meaning the data below primarily comes from the ACS 5-year estimates, which have relatively high margins of error in these small communities. Data on the Community Designated Place (CDP) of Newtok is listed in the following table.

### AVCP RHA Housing Needs Assessment (2012)

<table>
<thead>
<tr>
<th>Table 11: Newtok community information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2010 Population</strong></td>
</tr>
<tr>
<td><strong>2010 Occupied housing units</strong></td>
</tr>
<tr>
<td><strong>Average number of families per household</strong></td>
</tr>
<tr>
<td><strong>Average number of occupants per household</strong></td>
</tr>
<tr>
<td><strong>Average age for head of household</strong></td>
</tr>
<tr>
<td><strong>Percentage of households with a male head of household</strong></td>
</tr>
</tbody>
</table>
| **Average income per household**                             | Monthly: $2,151  
                          | Annual: $25,812 |
| **Average income per head of household**                     | Monthly: $1,896  
                          | Annual: $22,752 |

This housing needs assessment was summarized in a short document that gave general information about the community and population (AVCP RHA, 2012). It also tabulated findings from a survey of existing housing. Information was gathered from a survey distributed to Newtok households in 2010. A local interviewer, trained by AVCP RHA, went door to door with the survey questions (M. Charlie, AVCP Housing CEO, personal communication, March 9, 2016). The interviewer was able to obtain a total of 59 surveys, representing 84% of households. Survey results appear in the tables below.

<table>
<thead>
<tr>
<th>Table 12: Housing survey of existing housing in Newtok</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rehabilitation</strong></td>
</tr>
<tr>
<td><strong>Weatherization</strong></td>
</tr>
<tr>
<td><strong>New home</strong></td>
</tr>
<tr>
<td><strong>Multi-family triplex (1 household with 4 families)</strong></td>
</tr>
</tbody>
</table>

The second table summarizes the questions asked about houses in Newtok. The survey detailed home characteristics such as size, occupancy, age, the number and type of rooms, energy use, condition, and any repair needs. From this information, AVCP RHA was able to divide homes into three main categories: homes in need of minor weatherization, homes in need of major rehabilitation, and homes that would need replaced. Some families said they would prefer to live in an apartment complex, probably due to the potential for lower rent, if that option existed (M. Charlie, AVCP Housing CEO, personal communication, March 9, 2016).

Since this housing survey was conducted, there have been no repairs or weatherization of homes in Newtok. Funders are reluctant to commit to financing repairs or replacement of homes that will be left behind in Newtok in the upcoming move to Mertarvik. Thus, no work has been done to date in spite of the need for repairs to
existing houses.

**Denali Commission and Alaska DCRA Newtok Housing Analysis (2008)**

This housing analysis was conducted in 2008 by interns from the Denali Commission and the Alaska Division

<table>
<thead>
<tr>
<th><strong>Table 13: Newtok housing analysis results</strong></th>
</tr>
</thead>
</table>
| **Family makeup** | 1. Average people per household: 5.25. Occupancy ranged from one to 12 people in a single house. Many households also have guests or relatives stay with them during summer and/or winter seasons.  
2. No household has plumbing.  
3. Almost all families rely on subsistence activities for food; all families buy dry goods at the village store each month.  
4. The average cost of food for the 45 homes answering this question was $777/month with a range of $80 to $2,000. |
| **Property** | 1. The average stay in a home was 14.89 years, with a range of less than one year to 43 years.  
2. Residents either owned their home, rented from AVCP (average rent of $100), or rented from a private landlord.  
3. Most homes are heated by oil, electricity, or wood. Typical usage pattern was oil year-round with wood supplement during the winter. Average fuel use for the winter was approximately 205 gallons, with a range of 22 to 1,200 gallons.  
4. Other household expenses included telephone, electricity, water, cable TV, and internet. However, very few homes had TV or internet. |
| **Income** | 1. The majority of people are seasonal workers. Seasonal jobs in Newtok include the cannery, school teacher and aide, and construction.  
2. Almost all residents received the Permanent Fund Dividend and a Calista Corporation Dividend.  
3. Other income sources included food stamps, Temporary Aid for Needy Families; Woman, Infant, and Children checks; social security, including disability and retirement; unemployment benefits, veteran’s assistance; energy assistance from AVCP; retirement benefits; and other sources of income.  
4. Average household income was $2,439.86 per month for 26 households whose incomes were between $1,921 and $5,125 per month. |
| **Housing structure** | 1. Almost all residents were dissatisfied with their current housing situation. Reasons for this included that the homes were too small, too cold, had leaks, were drafty, did not have Arctic entries, had poor ventilation, had rotting walls, no plumbing, foundation problems and more.  
2. For Mertarvik home size: 10 households would like a larger home for people to live together; 7 households would like smaller, separated homes with fewer people; and 1 liked the size of their current home.  
3. Pictures of sample homes were shown to residents. 16 households preferred A, a white HUD home with a triadetic foundation. 14 households preferred B, a blue HUD home with 2 doorways, and a lot of windows. 6 households preferred C. 5 households preferred D, an earthen home.  
4. Ideal home characteristics identified by Newtok residents included having running water in the bathroom and kitchen, a few bedrooms, porches, laundry rooms, ovens and/or stoves, separate steam houses, Arctic entries and/or dry rooms, and two separate entrances for fire safety. |
| Community help | 1. 34 households would like to be involved in the building of new homes (only 3 do not want to be involved in building their new home).  
2. Over 20 households are willing to volunteer labor and time to build their own home; 5 households would build if pay were offered; for some households, the amount of time they could volunteer depends on their other work schedule. |
| --- | --- |
| Housing structure | 1. Almost all residents were dissatisfied with their current housing situation. Reasons for this included that the homes were too small, too cold, had leaks, were drafty, did not have Arctic entries, had poor ventilation, had rotting walls, no plumbing, foundation problems and more.  
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4. Ideal home characteristics identified by Newtok residents included running water in the bathroom and kitchen, a few bedrooms, porches, laundry rooms, ovens and/or stoves, separate steam houses, Arctic entries and/or dry rooms, and two separate entrances for fire safety. |
HOUSING DESIGN

Methodology

Alaska has a long history of housing designs that fell short of meeting the physical and cultural needs of its residents. Failure of outside firms to fully anticipate the extreme physical environment of the Arctic and Subarctic climate, as well as a failure to understand the lifestyle and use patterns of rural Alaskans, resulted in more failures than successes in housing design in the region.

The relocation of the community to the new site at Mertarvik represents a once-in-a-generation opportunity to establish housing that is suitable for both the local climate and culture. It is impossible for a single house design to work for the entire community and it is impossible to only have one company designing and constructing these houses. In order to build the houses that Mertarvik needs, it will take efforts from multiple organizations and companies. The AVCP Regional Housing Authority has been building energy efficient housing in the region for years and has been actively involved in the planning of housing in Mertarvik. As of this report, AVCP Regional Housing Authority will be constructing at least four new homes in Mertarvik in the Summer of 2017.

Over the years, CCHRC staff has worked closely with the Newtok Village Council, AVCP Regional Housing Authority, and local residents to learn more about their region and lifestyle, gathering input on multiple visits over the course of eight years. During these visits, and also during a formal charette process, CCHRC staff gathered input from villagers on the problems with their current housing, and explored possible solutions that the first new homes at Mertarvik could address. The primary goals of the design are to be energy efficient, warm, dry, mold free, durable, affordable, and replicable by local labor resources.

Any house that is built before village-wide infrastructure is present at the new site will need to be both self-sufficient and capable of plugging into that infrastructure when available. The need to relocate is too urgent to try and complete a fully functioning community grid, water and sewer system, and road system before the housing construction begins. The staged construction of housing will need to assume the first ‘Pioneer Houses’ will operate without the benefit of conventional infrastructure. If they can be designed to function off the grid until such time as village-wide infrastructure is implemented, then construction of both housing and infrastructure may take place concurrently without the absence of basic services or undo strains on quality of life. More conventional housing can then be constructed as conventional infrastructure is brought online.

The design of housing models for the community has also taken place in stages. In 2016, a demonstration home was designed with the community and built at Mertarvik. This demonstration home was built in six weeks with a local crew and CCHRC instructors as a training exercise for the local workforce to form a model for future work in the community. In the second stage, CCHRC staff returned to the community in November 2016 to discuss other possible housing models that would suit the needs of the community. Through this visit, it became apparent that the Newtok Village Council needed to see housing designs that have been built in other parts of the state that could work for them, and housing design concepts that were specific to their community and its needs. As no single housing model will suit the needs of every family and individual, CCHRC has included in this report, three house designs that are developed to 100% with included construction documents and three house designs that are developed to 15% that focus on needs expressed by the community during CCHRC’s site visits. The different types of housing included are the Demonstration House, the Octagon “Quinhagak” House to which many community members expressed interest, the “Hawk” Starter Home, an Extended Family Duplex with Universal Design Principles, a larger home with a loft for Multi-generational families, and a Transitional Modular House Design that could be built quickly, if disaster occurs before enough housing has been developed.
Above: One of the three original homes built in Mertarvik in 2005 at the creek site.

Above: The three additional houses built up the hill near the MEC around 2009.

Above: Two garage sheds built by the IRT. These sheds were used as a work camp by the crew of the CCHRC Demonstration Prototype Home constructed in 2016.

Above: Two more IRT work sheds, adjacent to the sheds pictured at left. These larger work sheds are empty.

Above: The CCHRC Mertarvik Prototype Home was built at the former IRT Bivouac Site in 2016. The Bivouac Site has enough room for approximately five more homes of this size to be efficiently constructed. The homes could then be moved to their final site/plat.
Foundation Considerations

The house designs included in this report with the exception of the Demonstration Prototype Home, have either been designed for a site other than Mertarvik or are not developed enough to have a foundation system designed yet. As a result, below are images and captions that show what has been done in Mertarvik and also show what has been done elsewhere in Alaska. This information can be used as a reference when determining the design of foundation systems for future housing.

Above: There has been significant movement in this pad. The IRT shed foundations are not adjustable.

Above: At the original houses near the spring at Mertarvik, post and pad foundations rest directly on the ground.

Above: At the homes near the MEC, dunnage posts rest directly on an oversize footing. This type of foundation is potentially unstable.

Above: An adjustable pile foundation under construction in the village of Atmautluak. A cheater bar was later welded onto the wrench for periodic releveling of the foundation.
Above: At the Newtok Site, a building is moved on skids at Breakup to a new location in the village using a small dozer.

Above: The Triodetic foundation in the Demonstration Home allows for adjustability should differential movement in the frost layer or permafrost affect the home. The skids allow the building to be moved from the Bivouac Site to the home’s final plat after construction.

Above: An adjustable foundation on cribbing in the village of Quinhagak. This home can be adjusted to account for movement of the ground over time.

Above: An octagonal prototype in Quinhagak with an on-ground foundation. The geometry of the home self-scours wind born snow to prevent drifting.

Above: A home at the Mertarvik site in early winter. Snow drifting has already begun to accumulate. Snow drift will need to be considered carefully in the layout of adjacent houses and shape of new housing to ensure that the drifting issues of Newtok are not a problem in Mertarvik.

Above: CCHRC has also designed and constructed foam “floating foundations,” which span variations in the pad below it, should changes in the thermal regime of the soil cause settlement. The foundation can also be jacked with spray foam back to level if necessary.
Mertarvik Demonstration Prototype Home

An inclusive approach to designing and building in rural Alaska was pioneered by CCHRC and members of the community of Anaktuvuk Pass, Alaska, in the summer of 2008. Following design development and review by community members and partners, the first prototype home was built with a local workforce and housing authority in 2009. The construction cost reduction, extreme energy efficiency, and livability of the home have been remarkably successful. The local housing authority in Anaktuvuk Pass maintained ownership of the plans and built seven more homes in the region in the following years. The process was repeated in the villages of Quinhagak, Atmautluak, and Buckland, where CCHRC staff worked with the local housing authority to design and build homes that reflected the climate and culture of the local people. Some of these prototypes were monitored remotely for fuel use, electricity use, and foundation stability. Modifications were made based on the first winter’s data and provided to the local housing authority or tribal government to improve on the designs.

The Mertarvik Demonstration Home was built in collaboration with village residents and has created mutual benefits for both partners. The CCHRC team has gained invaluable knowledge of physical conditions and adaptive techniques that can only be learned by living in a challenging environment for many years. In turn, the CCHRC team shares a knowledge base focused on innovation in building science and energy efficient construction practices derived from continuously evolving research and relationships with industry and professional communities.

The Newtok Village Council, village residents, and CCHRC staff worked together to finalize the design, select proper building materials, and choose the construction site. Due to the urgency of need for relocation, a construction staging site was chosen where homes could be built before traditional platting and siting was completed, with the intent to move homes to their final site as platting is finalized, without slowing down construction. Concurrently

Above: The Mertarvik Demonstration Home was constructed by a local crew and CCHRC instructors in six weeks. It was built at the construction staging area near the barge landing, and will be towed to its final plat once the site is fully surveyed for housing.
with design, the tribe served as Project Manager and employer during the build. Aside from CCHRC instructors, all construction labor was locally hired by the tribe.

The Mertarvik Demonstration Home addresses the needs of a Pioneer Structure at the new community site. It must be habitable and comfortable before conventional infrastructure is implemented in the community. The home has been designed for the Yukon-Kuskokwim Delta environment, where wind-driven precipitation and foundation movement are common causes of building failure. A limited cash economy and mostly seasonal employment opportunities demanded the home have very low operating costs and the short summer season required that it be quickly and economically constructed.

**Features of the home include:**
- A triodetic space-frame foundation that will allow residents to both adjust the foundation of their home without the use of heavy equipment should any movement occur over time;
- Ski-shaped footings integrated into the foundation that allow the building to be moved from the construction staging area to its final plat;
- An integrated truss frame that allows for simple, rapid framing of the shell, thick walls, and a complete thermal break in the walls, roof, and floor;
- An elaturaq arctic entry with a dropped floor that forms a passive cold trap at the entrance to the home;
- A complete thermal envelope with high insulated value and minimal thermal bridging;
- Simple and efficient heating and ventilation systems;
- An in-house water treatment plant that produces potable water from multiple sources;
- A waterless toilet that dries solids for less odor and easier disposal of waste in the community;
- A power system with a transfer switch that allows the home to run off generator power, battery power, or a traditional grid.

Perhaps even more importantly, the local crew who built the home will be able to put their skills to use in future projects. Besides providing well-paying jobs to local residents, this design drastically reduces the cost of construction. The resident family was required to provide at least one household member to take the construction course and work with the crew on the project. The resident was given thorough instruction in all aspects of their home’s components, operation, and maintenance requirements. The following pages show photos of the Mertarvik Demonstration Home, highlighting strategies for pioneer structures that are built before full services and infrastructure are present in the community. Some of these strategies, such as approaches to water, waste, power and heat, will be discussed in more depth later in this report.
Above: Until plats and pads have been developed, homes at the new site can incorporate ski footings to enable movement from the staging area.

Above: Integrated Trusses greatly speed up construction time during a short season.

Above: Spray-applied polyurethane insulation creates a monolithic thermal envelope and also functions as a vapor retarder in the home, creating an extremely warm building envelope that requires ventilation.

Above: Triodetic foundations allow for adjustability should differential movement in the permafrost affect the home.

Above: The crew framed out the entire integrated truss structure in 1.5 days.

Above: Durable cladding such as ribbed metal sheathing will stand the test of time while minimizing maintenance, repainting, or water damage over time.
Above: The floorplan of the Mertarvik Demonstration Home is compact and lacks hallways, an element requested by rural occupants. The arctic entry is inside the thermal envelope but unconditioned, and the walls are filled with 7.5” of spray-applied polyurethane insulation, forming a monolithic thermal envelope with no seams, cracks, or thermal bridges.
Power

Above: The two panels with invertor and transfer switch in the Demonstration Home.

Above: The control panel for the electric system and the ventilation system are adjacent to each other in the main living space, giving occupant control to both systems.

Above: An occupant of the Demonstration Home goes through training with a licensed electrical administrator.

Above: An occupant of the Demonstration Home goes through training with a licensed electrical administrator.
Ventilation

Above: The Heat Recovery Ventilator preheats fresh intake air before distributing it to the household.

Above: Residents of Atmautluak install a separating toilet in a prototype home.

Above: The Demonstration Home in Mertarvik uses a separating toilet as the exhaust port for the ventilation system. This keeps odors out of the house and accelerates the drying of solids. A damper keeps the system from short-circuiting the toilet when the ventilation system goes into recirculation mode.
Water and Waste

Above: The spring at Mertarvik has been a source of fresh water for generations. Laborers and visitors often stop to take on water here.

Above: Melted ice is a common source of fresh water in the water.

Above: The water treatment plant in the Mertarvik Demonstration Home.

Above: Close up view of the pump and filter in the water treatment plant in the Demonstration House.

Above: A local elder in Atmautluak explains the operations of the portable water treatment plant in Yup’ik.
Above: Campwater Industries and CCHRC Staff constructed a hand pump and well house to be used during the transitional phase.

Above: The original wellhead at the Mertarvik Evacuation Center site.

Above: The Alaska Lions Club funded the construction of the wellhouse at Mertarvik. This building, along with the water treatment plant, was used by residents at the Mertarvik site in summer 2016.
Above: The separating toilet comes with an optional urinal, or can separate the liquid and solid waste internally as well.

Above: An existing incinerator is used for garbage at the Mertarvik site during the transitional phase.

Above: The Demonstration Home in Mertarvik uses an oil drip stove, which does not require electricity to heat the home. Once electrical infrastructure is present in the village, homes may use the more common monitor or Toyo heating appliances.

Above: The septic and drainfield for the Mertarvik Evacuation Center is already in place, and may be a resource for waste disposal during the transitional phase.
Octagonal “Quinhagak” House

In 2010, CCHRC worked with the village of Quinhagak to build an energy efficient octagonal house that reflected the climate and culture of the village. The Quinhagak Prototype Home was designed for the environment of the Yukon Kuskokwim Delta, where wind-driven rain and snow causes extreme building failures among many homes. The octagon shape lessens the surface area-to-volume ratio, significantly reducing the amount of surface area exposed to the cold compared to a rectangular model the same size. An elaturaq, or arctic entry, is wrapped around two of the eight walls, further improving heating efficiency and protecting the home from wet winds. The form of this house channels wind around the building, allowing for the scouring of snow in front of doors and windows, lessening problems with snow drifts.

Plan
This house has 1080 Square Feet, 900 of which are conditioned (heated). It has three bedrooms, a bathroom, mechanical room, and a U-shaped kitchen that opens to the living/dining area. The open plan allows for more family interaction and lessens the possibility of cold areas within the house. The walls of this house are each 14 Feet. The length of these walls can be easily increased to make a larger floor plan that could provide more storage space or possibly an additional bedroom. For storage, there is a pantry in the kitchen and a large arctic entry.

Walls
The walls of the prototype are comprised of 4” metal studs on the inside, a 3.5” plastic spacer in the middle, and a light-gauge angle-iron that holds the siding 7.5” out from the inside of the stud. The non-conductive plastic spacer minimizes the heat that escapes through the studs. Spray foam is applied continuously to the foundations, walls, and roof, creating a monolithic envelope with no gaps or thermal bridging. The design creates a simple, super-insulated wall (R-40) without the added material of traditional double-wall construction. The wall is light enough that it can be lifted and installed by four men.

Above: The octagon-shaped prototype house in Quinhagak reflects traditional housing in the Bering Sea community.
Quinhagak House
Kuinerramiut Ena
900 SF (conditioned)
1080 SF (total)
Above: The octagon form of the Quinhagak House allows the wind to move around it, scouring snow from the ground and preventing drifts in front of windows and doors.

Above: The sections of wall are light enough for four men to carry to foundation during construction. The wall system can be prefabricated inside a shop during the off-season or inclement weather and carried to the site during construction.

Above: Picture of interior. View looking from living/dining room into Kitchen during construction.

Above: Picture of interior. View looking from Kitchen into Living/Dining Area showing open plan and lots of natural light through windows.

Above: Picture of interior during construction. View looking from bedroom into living/dining area, showing kitchen and bathroom entrance.
Roof
The Quinhagak roof features a pair of central steel hubs: the lower hub holds the bottom chords of the roof trusses in balanced tension and the upper hub holds the top chords in compression. This assembly allows the truss length to be half as long to span the building, which saves on shipping costs. Additionally, the hub allows for an open floorplan without columns. The roof is vented so it can dry out if any moisture works its way into the assembly.

Foundation
Unlike most foundations in the region, the original Quinhagak prototype rests directly on an overbuilt gravel pad. The floor joists were elevated off the ground with EPS foam board spacers, and soy-based polyurethane foam was sprayed through the joists directly onto a geo-textile mat. This raft-like foundation provides an insulation value of R-60 and a very effective thermal break, so heat from inside the home can’t escape through the floor joists directly into the ground.
After the original prototype was built an alternative foundation was developed that is on an adjustable post and pad foundation to be used where the ground is subject to larger amounts of surface and in-ground water flows.

Above: Exploded axonimetric drawing of wall system. Metal studs and offset angled metal that siding is fastened to.
Spenard Builders Supply-CCHRC 20x20 house/Starter Home

The ‘Hawk’ was designed by Spenard Builders Supply as a 400 square foot starter home. Exterior framing dimensions measure 20’x20’ Included in the floor plan is an arctic entry, and a separate room that serves as a bathroom and/or utility room, depending on need. The remaining useable space follows a studio apartment in function, whereby the kitchen, living room and bedroom all share the same space. This dwelling has provisions for both a wood stove and a Toyo type oil fired space heater. As none of the interior walls are structural, the floor plan can be readily changed to suit occupant needs.

The purpose of the ‘Hawk’ design is to provide a competitively priced smaller home that can be constructed quickly with a minimum of skilled labor. As the structure is smaller, the materials package is compact and several homes can typically be sent in one shipment.

This home can readily meet AHFC 5star plus energy requirements in any of the 4 climate zones found within the state. The exterior walls are built using the REMOTE wall system, where varying thicknesses of foam board insulation are applied to the building exterior. For example, 4” of exterior insulation could meet energy standards in Southeast and Southcentral, while 6” of exterior insulation would meet energy efficiency requirements for the colder climates encountered in Alaska’s interior. The added benefit of the exterior insulation approach is that this system, when properly detailed, provides a vented rain screen directly behind the siding. A draining type house wrap behind the foam board provides an additional drainage plane behind the foam board. A section drawing of the REMOTE Wall is shown in this section and the construction manual is provided in the appendices. The roof system is a standard vented truss roof covered with metal roofing while the floor system contains batt insulation followed by a weather barrier and a continuous layer of foam board on the underside.

A wood frame structure of this type will a provide durable, long lasting structure that performs very efficiently in
SPENARDS 20x20
CCHRC UPGRADE JULY 2013
Section Through REMOTE Wall

[Diagram showing a cross-sectional view of a wall with labeled components such as roof sheathing, self-adhering membrane transition over wall, drip edge, gutter, fascia, etc.]

- Energy heel truss
- 18 inch blown-in cellulose, 20 inch fiberglass insulation or as specified
- Vapor and moisture retarder
- Gypsum wall board
- 2-2x4 top plates
- R-11 or R-13 batt insulation optional
- Exterior membrane
- Structural sheathing
- Gypsum wall board
- Stud
- Gypsum wall board
- Bottom plates
- Subfloor sheathing
- R-11, R-13 batt insulation, or high density sprayed-in foam against rim optional
- Floor joist
- Treated wood sill
- ICF foundation wall
- Gravel fill for drainage
- Sealant (continuous bead to seal vapor retarders)
- Grade
- 40-60 mil self-adhering waterproof membrane (similar to equivalent)
- Rigid foam board insulation (applied for below grade)
- Polyethylene vapor and gas retarder
- Footing
The family unit, in general, is ever changing. It increases in size due to children being born, marriages, and accepting extended family into the household. It decreases in size because of marriages, death, and people moving on to another phase of life (schooling, career, etc). It is difficult to design a house for such a dynamic unit. Yet, it is evident that the residents of Newtok need a house design that attempts to allow for these changes. CCHRC is proposing this 15% design concept of a duplex that is not necessarily meant for two separate households. One side of the duplex is a three-bedroom unit and one side is a one-bedroom unit. The units share a porch and an arctic entry. The one-bedroom unit was developed using universal design principles and a ramp to the porch was included in the design for wheelchair accessibility. As a result, one family could occupy the duplex in a variety of ways. The one-bedroom unit could be used for an Elder, who wants to maintain some independence, but still be with the family, it could be a starter home for a couple with a new baby, or rented out as a means of extra income for the household. In addition the three-bedroom unit’s bathroom has been planned so that it could easily be adapted to meet universal design principles for accessibility if a person using a wheelchair were living in that unit.

The structure is simple and can use a variety of construction techniques such as double wall stick framing or an Integrated Truss System, shown in the Demonstration House above. As shown here, the house is 64 Feet x 28 Feet for a total of 1792 Gross Square Feet. The three-bedroom unit is 1009 Square Feet and the one-bedroom unit is 422 Square Feet. The shared arctic entry is 61 Square Feet and the shared mechanical room is 66.5 Square Feet. It is adequately sized for a large chest freezer or coat and gear storage. Both units are “open-plans”, where hallways are not used. This design provides for more communal interaction between occupants and makes it easier to maintain a consistent temperature throughout the house.
DUPLEX FIRST FLOOR PLAN

BEDROOM 1

BEDROOM 2

BEDROOM 3

LIVING ROOM

BATH

KITCHEN

DINING

W/D OR PANTRY

ARCTIC ENTRY

MECH

ACCESS RAMP

STAIRS

SHARED PORCH

ACCESS RAMP

10'-0"

28'-6"

7'-1 1/2"

16'-1/2"

28'-0"

9'-6"

12'-1/2"

2'-3"

9'-3"

5'-0"

64'-0"

12'-0"

7'-1 1/2"

18'-3"

7'-5"
The ramp could be built using wood deck construction techniques or use a prefabricated modular ramp with an adjustable foundation such as the one pictured above sold by Disability Systems, Inc. (CCHRC does not endorse a specific manufacturer or distributor.)

CCHRC recommends the duplex use CCHRC’s BrHEAThe v2.0 combined heat and ventilation system. This system incorporates the HRV into the heating system. The HRV is tied to the boiler via a separate zone and a heat exchanger. Thus, the HRV provides fresh air and heat to all the rooms. This system ensures proper ventilation of the house for healthy indoor air quality while ensuring that the fresh air is heated to a level that is comfortable for occupants. CCHRC has tested and vetted this system and it can be built and maintained with standard parts. In order for this system to perform adequately, the duplex would need to be very well insulated. The duplex units would share a boiler but have two separate ventilation systems that use a Heat Recovery Ventilator (HRV). A diagram describing the system is pictured below.
Above: Diagram describing BrHEAThe System. Left: Picture of fabricated filter box / heat exchanger necessary for system.
Overcrowded houses are a typical problem in rural Alaska and the village of Newtok is no exception. The typical solution to this problem is to build more houses that are all roughly 1100 to 1200 Square Feet and have 3 bedrooms. Although more housing always eases the burden of overcrowding, it is not a solution that works for all families. Based on feedback from the November 2016 community meeting CCHRC held with the residents of Newtok, it became evident that not all families want to divide into separate houses. They do, however, know that most houses are too small for very large families such as ones that include multiple generations and extended family. CCHRC wanted to demonstrate what this type of house may look like with this 15% design concept.

This house is 1400 Gross Square Feet plus a loft and exterior porches. The first floor has an interior of 1210 Square Feet and the loft is 224 Square Feet. The first floor has three bedrooms, an “open plan” living and dining room, a kitchen, bathroom, arctic entry, and a mechanical room with a separate entrance. The bathroom sink has been separated from the bathroom that has the toilet and bathtub/shower. When there is are many people living in one house, this gives access to the sink at all times for hand-washing, etc. The enclosed bathroom has been designed to be adaptable to universal design principles. If necessary, grab bars, a zero-threshold shower, and comfort height toilet could be added. It has been planned with the prescribed clearances in front of the tub, toilet, and sink.

The loft was included in the design as a multi-purpose space. It could be used for more storage, but a full stairway and an egress window has been included so that this space could be considered habitable according to building code. It can be used as a guest room, another bedroom, a sewing room, children’s play area, etc. According to the International Residential Building Code Section 304.4, only the portion of the loft with a ceiling height of 5 Feet can be included in the total habitable area. The 224 Square Feet mentioned earlier only includes this area. Another portion of this loft that has ceiling height below 5 Feet has been enclosed and can be used for mechanical equipment and storage.
Above: Rendering of 3D Computer Model of House showing bedroom and living room windows.

Above: Rendering of 3D Computer Model of House showing bedroom and living room windows.
FIRST FLOOR PLAN

BEDROOM 1
BEDROOM 2
BEDROOM 3
KITCHEN
MECHANICAL
OPEN STORAGE
DINING/LIVING
PORCH
SPACE FOR FREEZER
ARCTIC ENTRY
36'-0"
3'-0"
11'-5"
9'-6"
LOFT PLAN

INDICATES HABITABLE SPACE W/ CEILING HEIGHT ABOVE 5'-0”
In addition to a larger house with flexible space, CCHRC wanted to offer a design that reflected the culture of the region through its historical dwellings. Historically the Yup’ik people of Nelson Island lived in Qasgiqs and Enas as seen in adjacent photos (historic Nelson Island photos). A Qasgiq was a traditional large semisubterranean men’s community house used for communal gatherings as well as housing the men that were old enough to live without their mothers. The women and children lived in similar, a smaller structure, called an Ena. A picture of a community of these dwellings in Hooper Bay is shown in photo below. CCHRC has determined that it is not cost effective to place the new houses on Mertarvik into the hillside, but gave thought to the aesthetic appearance of this house to reflect the same form of these traditional houses. Therefore, the roof cladding wraps around the house and becomes the cladding for two of the walls. One side of the roof slopes down to the ground and the use of lumber at the entrances of these houses and in the storage areas reflects the entrance to the traditional Qasgiq and Ena dwellings. See renderings of house on next page.
Other aspects of cultural importance to the current residents of Newtok are maqis, or steam houses, and fish drying racks. The maqis are not only used for bathing, but for mental and physical healing and the subsistence lifestyle of the Yup’ik necessitates a fish drying rack. CCHRC thinks it is important to recognize the maqi and the fish drying rack as part of a Yup’ik house and include it in the design of the new houses in Mertarvik. It is standard practice in remote rural Alaska construction, to order 10% more of each material since often material is cut incorrectly during construction or used in the incorrect location and there is no convenient way to buy more materials quickly. As a result, there is often material left over after a house is built. CCHRC thinks that it will be possible, with input from Newtok residents, to design a simple maqi using the 10% extra materials. If the maqi is designed to do use this material, it will not only embrace this cultural aspect, but will reflect an aesthetic similar to the house.
FISH/SKIN DRYING RACK

MAQI

ENTRY DOOR

EXTERIOR WOOD FRAMING

36'-0"
CCHRC proposes the use of the REMOTE Wall System for the construction of this house, but other construction systems could be used. The REMOTE Wall System is a building envelope technique described earlier in this document, see section on the 20x20 Hawk House. The house design features a roof that wraps around two of the building’s walls. The REMOTE Wall System provides an easy way to insulate the walls and roof in a continuous manner that this design requires.

If the REMOTE Wall construction technique is used for the building envelope, or an alternative super-insulated type of construction, CCHRC proposes the use of the BrHEAThe v2.0 system for heating and ventilation. This system allows for the incorporation of solar thermal water heating and provides warm, healthy, fresh air throughout the house. The BrHEAThe v2.0 system is described in the section on the 15% Duplex design.

This house has flexibility to be oriented based on what the occupant desires, or what the site requires. The entrance side of the does not have any windows which prevents less heat loss when this side is facing north. But, the entrance side roof is also sloped at an angle appropriate for solar panels (photovoltaic or thermal) if facing south. The opposite side of the house has large windows that if facing south, would allow a lot of natural light and passive heat gain into the house. If this side faces north, it would allow for a potential view to the water. Although the slope of the roof on this side is not ideal for solar panels, they could still be mounted to this roof using brackets that would hold them at the correct angle off of the roof.

Above: Perspective views of 3D Computer Model showing different orientations.
Transitional Housing

Most current home designs proposed for Mertarvik require a crew of approximately six people and a minimum of six to eight weeks to build, limiting the number of homes that can be built in one season. In the event that the current village in Newtok is rendered uninhabitable by erosion before a sufficient number of homes are built in Mertarvik, there needs to be a way to build more homes in one season. One solution is modular homes. These homes are comprised of multiple units that are prebuilt in a shop and can be shipped and assembled on-site. The shop could be located in Bethel, Anchorage, or Fairbanks. Modules could be built over the course of a winter and shipped and assembled in the summer. It is even possible to set up a large fabric tent shop in Mertarvik to extend the construction season.

This design utilizes two modules that are each 12’ wide and 40’ long. The modules can be transported to Mertarvik using equipment that will be in place for the road construction. They would be shipped complete with siding and interior finish, and would be placed on a steel beam foundation. A truss roof would be installed, sheeted, and covered with metal roofing. Stairs and a porch would complete the home.
The home is designed to be heated with an oil boiler and HRV combined system (BrEATHe). A woodstove could be added as backup heat. The bathroom could be outfitted with a transitional system such as the Portable Arctic Sanitation System (PASS), a gravity-fed water system and waterless toilet. Once central water and sewer is functional in Mertarvik, a full bathroom with shower and flush toilet can be installed in the space. Supply and drain lines could be roughed in during construction. The cook stove will be a 220 electric range/oven. The asymmetrical roof design will work well for solar panels if the house is properly situated.

The interior layout of the home is designed to function as a two-plus bedroom home. There are two full bedrooms with flexible space in between for bunk beds and a table. The flexible space is an area that could be used by younger children or visiting family members. The table could serve as desk for homework or recreation projects. There are sliding doors to close this space off from the main living area.

The entrance includes an arctic entryway, meant to be conditioned— but cooler than the living space. This space has room for chest freezers and for storing food that should be kept cool but not frozen. Next to the entry there is a small shop space that can be accessed from the outside. The double doors are wide enough for a snow machine or four-wheeler to be pulled inside for repairs. This space can be heated as desired.
INFRASTRUCTURE NEEDS

Pioneer Phase House Systems

Staged village relocation poses unique challenges to infrastructure design. It is difficult to create housing without power, water, or waste infrastructure and still provide an acceptable standard of living. However, there is simply not enough time to design, fund, and build a power grid, water and waste system in Mertarvik before residents begin to move. It is vitally important that the construction of housing not be hindered by the timeline necessary to create village-wide infrastructure. Instead, “pioneer families” will need to move from Newtok to Mertarvik in order to create a foothold in the community. Only then will funding from certain agencies (the school district, the Federal Aviation Administration) be possible. For the first phases of pioneer occupation, a “micro-infrastructure” approach is encouraged for new housing. Below are some examples of this approach.

Power & Heat

Homes that are constructed before a village-wide grid is available must be self-sufficient for heating and electric generation. Current pioneer housing at the Mertarvik site incorporates generators and woodstoves. The Mertarvik Demonstration Home adds a transfer switch and battery bank to the electric system, so even when the generators are not running, a separate panel powers systems such as lights, ventilation, and a small number of receptacles. The Demonstration Home utilizes an oil drip stove, which does not require electricity. The inverter on the Demonstration home is solar/wind ready, and future “pioneer-stage” homes should also be wired with a transfer switch, two panels, and inverter. A diagram of this system is provided on page (XX) Once village-wide power infrastructure is introduced, these homes can be linked to the grid.

Ventilation

Modern energy efficient homes are much less drafty than the existing structures in Newtok and will require mechanical ventilation. Heat Recovery Ventilation is recommended for all new housing units at the Mertarvik site. In the Demonstration Home, the exhaust air duct is the toilet, which helps dry solid waste and eliminate odor from the house (See figure XX).

Above: An oil-drip stove allows for heat without needing electricity, an important feature in the first pioneer homes built before the grid.

Above: Heat Recovery Ventilation saves energy by preheating incoming air while ensuring safe and healthy indoor air quality in the home.
Water & Wastewater

Newtok has no water or waste system. Honey buckets are dumped in the river and water is hauled from a treatment plant. Two freshwater wells have been dug at the Mertarvik site, and one was developed into a hand-pump system with enclosure in 2016. The water is clean but has some turbidity. The Portable Arctic Sanitation System (PASS), developed by ANTHC and CCHRC in 2015, will treat water gathered from the wells, the existing spring, rainwater catchment, or melted ice and make it potable. A diagram of the PASS System is located on page (XX) A PASS tower was set up next to the well enclosure in Summer 2016 for pioneer residents to become accustomed to the technology.

There is a fully functional septic and leach field system adjacent to the Mertarvik Evacuation Center (MEC) foundation. There is also an incinerator at the Mertarvik site. Design of a drop-off point to the septic and leach field is necessary for the pioneer stage of inhabitation at Mertarvik. Residents will be able to drop off honey-bucket waste at this location until the village-wide water/sewer system is implemented. Residents utilizing separating toilets would be able to drop off the desiccated waste at either the septic or the incinerator. Other decentralized systems are encouraged for future housing that is built before the water/sewer system is completed.

With these decentralized approaches to infrastructure, families can move to the Mertarvik site and enjoy a similar or even improved standard of living as their home in Newtok, even before conventional infrastructure is constructed.
Merktarvik “Pioneer Home”

**POWER MODE**

When the generator is **RUNNING** it is using **GAS** and charging the **BATTERY**. **ORANGE** and **WHITE** outlets have **POWER**

![Diagram showing generator, battery, orange outlets, and white outlets connected to various appliances.](image)

- **GAS** to generator
- **BATTERY** to orange outlets
- **ELEC RANGE**, **MICROWAVE**, **COFFEE POT**, **FREEZER**, **PLAYSTATION**, **EXTerior + ELATURAQ OUTLETS** to white outlets
- **HRV**, **LIGHTS**, **SMOKE DETECTOR**, **TV + Small Electronics**, **LAPTOP**, **VHF**, **REFRIGERATOR** to orange outlets

**Note:** When the generator is **NOT RUNNING**, the **BATTERY** is providing **POWER** to the **ORANGE OUTLETS** only.
**QUIET MODE**

When the generator is **NOT RUNNING** the **BATTERY** is giving **POWER** to the **ORANGE** outlets only.

- **BATTERY FULL**
- **ORANGE OUTLETS**
  - POWER USE
    - HRV
    - LIGHTS
    - SMOKE DETECTOR
    - TV + Small Electronics
    - LAPTOP
    - VHF
    - REFRIGERATOR

- **WHITE OUTLETS**
  - NO POWER

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**Power System**

- **GAS**
- **GENERATOR**
- **LOW**
- **MICROWAVE**
- **COFFEE POT**
- **FREEZER**
- **PLAYSTATION**
- **EXTerior +**
- **ELATURAQ OUTLETS**
- **TV + Small Electronics**
- **LAPTOP**
- **VHF**
- **REFRIGERATOR**
CLEAN WATER AND SAFE WASTE DISPOSAL FOR ALASKA

ANTHC is partnering with CCHRC, CampWater Industries, and Lifewater Engineering to develop an In-Home Sanitation System for the community of Kivalina, located on a small island in the Chuckchi Sea in Northwest Alaska. Kivalina residents currently ration water and use a self-haul honeybucket system for sewage. The village is threatened by erosion and plans to move to the mainland in the future, which means they cannot get funding for a permanent piped sewer system. The system developed for Kivalina will be tested in nine volunteer homes during 2015-2016. The systems are designed to use rainwater catchment and other traditional water sources, on-site water purification, and safe disposal of waste. The systems are 'stand-alone' models, meaning that as homes are moved to the new village site away from the eroding coastline, they can bring their clean water and safe sewer with them. The testing going on in Kivalina today will help other remote communities address their own water and waste needs, and improve life for Alaskans.

KEY
A) RAIN WATER CATCHMENT  F) GREY WATER TANK
B) INTEGRATED VENTILATION  G) WATERLESS URINAL
C) GRAVITY FEED SUPPLY  H) WATER TREATMENT
D) SEPARATING TOILET
E) LOW-FLOW SINK
CLEAN WATER AND SAFE WASTE DISPOSAL FOR ALASKA

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The testing going on in Kivalina today will help other remote communities address their own water and waste needs, and improve life for Alaskans.

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**KEY**

A) Rain Water Catchment  
B) Integrated Ventilation  
C) Gravity Feed Supply  
D) Separating Toilet  
E) Low-Flow Sink  
F) Grey Water Tank - Purges To Outdoors When Full  
G) Waterless Urinal  
H) Water Treatment Plant

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Mertarvik Housing Master Plan  
CampWater Industries  
Lifewater Engineering  
Cold Climate Housing Research Center  
www.cchrc.org
Village-Scale Infrastructure
A major challenge facing the Mertarvik project is the need to relocate community members before final village infrastructure is in place. This means homes will need to operate independently of central utilities, but be connected when necessary. The Mertarvik Design and Construction Team headed by DOWL is currently developing that schedule.

As of December 2016 ANTHC is developing a comprehensive site plan for Mertarvik with the locations of all building lots, roads, major buildings, and utilities. Initial quarry development and road construction is slated to occur during summer 2017. ANTHC is designing a buried pipe water and gravity sewer system. AEA is working on a design for the power generation and electrical grid. AEA will also be planning the bulk fuel plant. ANTHC is currently coordinating with telecom companies about how to provide phone and data to the communities.

Roads and Foundations
As part of the townsit plan, ANTHC is laying out the locations of roads, services, and buildings. Goldstream Engineering is designing the roads. Currently the plan is to build a road to the quarry and approximately 2,000 feet of housing subdivision road with gravel pads for houses in the summer of 2017. Pioneer houses have been designed and built with triodetic foundations and skids so they can be moved to permanent locations at a later date. Until roads and gravel pads are in place, houses will be constructed such that they can be easily moved to their final location.

Post and pad foundations are typically the most economical foundations for residential structures. Post and pad foundations for residential structures should be designed so occupants can easily adjust and level the foundation without heavy equipment. That said, shallow bedrock does exist on site and may allow economical construction of a variety of permanent foundation systems. Permanent foundations would last for many decades with little maintenance. Larger structures requiring stronger foundations can hopefully be located in areas of shallow bedrock. Initial cost of installing a permanent foundation should be carefully weighed against the long-term value of that structure to the community. For instance, the feasibility of driven piles depends on the cost and availability of pile-driving equipment. As the bedrock is shallow, the shorter pile depth and reduced installation time may make such foundations viable—particularly for buildings such as washeterias, stores, clinics, schools, and equipment garages. Concrete foundations should also be considered; there is suitable aggregate available in the quarry, and Portland cement could be shipped in. Further evaluation is needed to determine whether sand is available on Nelson Island in sufficient quality and quantity. Beach sand in its natural state is usually not suitable for concrete due to the salt content and possible presence of organic matter. The cost of washing the sand will have to be weighed against the availability of sand from others sources, such as the quarry.

Water/Sewer
ANTHC is designing the water and sewer system for Mertarvik. They are currently planning on a piped water and gravity sewer system. The water supply will be sourced from wells while the sewer system will drain to a treatment lagoon. Because these systems may not be complete until the later phases of village construction, most of the houses should be designed with self-sufficient water and waste systems. The existing well can be used with a water hauling system. A water and waste treatment system like the Portable Arctic Sanitation System (PASS) could be used. A honey-bucket or sewage haul system is the least desirable option. In the intermediate stages of village construction a washeteria will serve as the central watering and laundry spot. When the central water/sewer system is complete houses could have traditional showers and toilets. Houses should be designed with a large enough bathroom to accommodate these options in the future, and keep walls in those rooms 2x6 or thicker to accommodate future plumbing. It is not recommended to install conventional plumbing fixtures until the water sewer system is complete.
Power
The first pioneer houses have been designed with standalone power systems, including generators, batteries, and inverters. These houses can also be connected to grid power when it is available. The growth and transition of the power grid is currently being discussed with AEA and the Newtok Contractors group. Some of the generators used for the man camp and road construction projects may be available to form a small grid that could power some of the early homes. Long-term, Mertarvik is an ideal situation for a smart micro-grid with a high percentage of energy sourced from renewables. Diesel will be the main power source for the grid. AEA is considering a wind system with electric boilers in main community buildings to moderate the load. Solar power may be economical on an individual or a community level. Houses should be built renewables-ready, with wiring and junction boxes in place so solar panels or other alternative energy sources can be added later. If there is a wind system that uses excess wind energy to generate heat in the washeteria, the community should consider incentivizing use of the washeteria at times of high wind; possibly lower laundry rates at times when the renewables portion of the grid is generating excess power.

Fuel
The pioneer homes are heated with oil drip stoves and electrical power is supplied with gas generators. Once a reliable electrical grid is in place, homes can move away from independent gas generators and drip stoves and move toward oil boilers with combined heat and HRV systems (the BreaTHE system). Residents have requested that woods stoves also be provided as a alternative heating source. The Alaska Energy Authority will design a bulk fuel storage facility and distribution system.

Heating fuel consumption of homes will vary based on quality of construction, heat source for domestic hot water (oil or electric) and occupant behavior. AHFC energy ratings produced with the AkWarm software can give a good indication of energy consumption. A 1200-square-foot 3-bedroom home in Mertarvik built to five star BEES standards would be expected to burn approximately 275 gallons of fuel per year for its heating load. The same house built to a Six Star standard would burn 165 gallons and an older or poorly built house that only rates 4 stars would burn 470 gallons. If domestic hot water is added to the heat load, houses could burn an additional 150 gallons of fuel, or 5000 kWh. If the electricity for the domestic hot water is diesel-generated, it would consume between 400 and 730 gallons of diesel in the generator.

Phone/Data
Houses should be wired with Cat 5 or Cat 6 for future phone and DSL data service. It is possible that this service will be entirely wireless, but the up-front cost of building the houses with data cables is minor. Also, metal siding and foil-faced foam insulation can interfere with wireless signals.

School
The school district requires 25 full time students before starting the planning process for a new school; however ANTHC has engaged the school district and is discussing operating the Mertarvik School as a satellite facility to the Newtok School. It is likely that the school will offer distance education during the transition, possibly utilizing the Mertarvik Evacuation Center or other community space. Ideally the planning for the school would take into account that the school functions as a community center and multipurpose building. This concept is explored in “Kindergarten through Career, Expanding the Concept of “School” in Rural Alaska” from Governor Walker’s office.
SITE PREPARATION

During the development of the proposal for the Technical Assistance Grant for developing the Surface Housing Master Plan, Site Control of Mertarvik for development purposes had not been obtained. As a result, one of CCHRC’s tasks was to assist the Newtok Village Council with obtaining site control. When CCHRC was awarded the grant, Site Control had been obtained. As a result, CCHRC’s assistance in this area was no longer needed.

However, through CCHRC’s work on this master plan, it became evident that a resource that would be helpful to the Newtok Village Council during future housing development phases would be a guide, or checklist, for what to consider when making decisions on planning and developing a house site and selecting the house that will go on the site. Below is a list of questions and considerations that should be used as a reference throughout development of Mertarvik.

House Site Considerations for Preparation & Planning

Setbacks and Easements
When making decisions regarding lot sizes or where a house will be placed on a site, consider what the easements, setbacks, and right-of-ways are. If these have not been determined, ordinances regarding this need to be in place to avoid future land disputes, hindrances to development and access.

Utilities
1. If Utilities, Water; Waste (septic, haul, sewer, Lifewater STP, other); Power; Phone & Internet, are in place in the village, consider how much it will cost to bring utilities to the house when determining the location of the house within the site.

2. It is not likely that individual wells will be drilled, but if a well is needed for water, determine where it will be before siting the house. Is a permit needed before drilling the well?

3. If a septic system is possible (soil percolation tests have been completed), consider the best location for a drain field when siting the house location. Septic systems are required to maintain at least 200’ from public wells and 100’ from private wells. Access to pump the septic tank should also be considered. There should be room on the lot for a replacement drainfield in the future. In some cases there are minimum lot sizes for septic systems. It is likely that using individual septic systems with drainfields will result in an unacceptable degree of sprawl in the village layout.

Topography (slopes) & Road/Walkway Access
1. Will the house require a driveway, boardwalk, walkways, or gravel pad? The cost of materials for these items may determine how close to the road the house needs to be.

2. Will the site require any excavation or grading? Will a gravel pad be needed to level the site or be needed for the foundation?

3. Consider drainage planes when siting and orienting the house.
Building Orientation
Typical village and urban plans orient the entrance of the house to the roadway or main pedestrian path. This isn’t always the best orientation for obtaining the best views or with regards to solar heat gain, photovoltaic panels, or thermal panels. These factors will all need to be weighted to determine the best compromise between them.

1. If solar exposure is important to the design of the house or future occupant, determine which direction is South on the site. This will help to determine which direction the house should face to gain the most passive solar heat or where solar photovoltaic/thermal panels need to be placed. Home design with roof pitches designed for installation of solar panels should be situated accordingly.

3. Consider what views are important and adjust building orientation accordingly.

4. Consider importance, or lack of importance, to the entrance facing road or walkways and adjust building orientation accordingly.

Soil Type
When deciding on a foundation system, determine what soil conditions are on the site based on results of soil borings done on or near the site. The foundation system may have a factor on the design of the house or which house design can be used.

Wind Direction and Snow Drift
Drifting snow has caused significant problems in Newtok, blocking entrances and windows to buildings. Some of this problem can be lessened based on the shape/form of the building, but some of it relies on building orientation and proximity to other buildings. Houses need to be spaced adequately apart to allow the snow that is carried by the wind, which slows down when passing over a house, to have adequate space to fall to the ground before another building is in the wind’s path. Orienting the building so that the entrance is not in the leeward side of the building so that snow does not block the entrance. It is better if the wind can scour the entrance to a building.

Staking the House
It is important to stake out the corners of the house before dirt work (excavation, creating gravel pad for foundation, etc). This way the placement of the house is ensured to meet all easement and setback requirements.

Above: House in Newtok where snow drift has blocked main entrance.

Above: House in Newtok where snow drift has blocked egress windows. The entryway has been dug out.
Funding for housing and infrastructure in Mertarvik will need to come from a variety of sources as no single funding source will be sufficient to build all the necessary homes. This chapter lists funding sources that have been or are currently being utilized for Mertarvik homes, as well as possibilities for future funding opportunities. These funding options are broken down by federal agencies, state agencies, and other sources.

Where possible, specific details are included on how the funding might be utilized in Mertarvik, and the first steps to apply for that funding source.

Current funding sources

The first homes were built in Mertarvik in 2007. Additional homes were built in 2012, and a prototype home was constructed in 2016. Funding is currently in place for further development of infrastructure and housing.

Denali Commission

The Denali Commission provided funding in 2016 to DOWL Anchorage for overall relocation planning. As part of this planning, DOWL is coordinating with agencies and the Newtok Village Council to plan infrastructure for energy, housing, and other needs in Mertarvik.

Association of Alaska Housing Authorities (AAHA)

AAHA funded the Mertarvik Housing Master Plan Report through a Training and Technical Assistance Program grant. Funding for Training and Technical Assistance grants comes from the Alaska Housing and Urban Development Office of Native American Programs (HUD ONAP) and is provided to the technical provider through the Alaska Regional Housing Authorities. For this report, funding went to the Cold Climate Housing Research Center (CCHRC) through AVCP Regional Housing Authority.

The lead contacts for the grant are the AAHA Administrator, Colleen Dushkin, and CCHRC project manager, Judith Grunau. AAHA awarded a grant of $209,000, in Spring 2016 for the research and writing of a Housing Master Plan. In addition to this Funding chapter, the report also addresses site control, housing development need, infrastructure needs, and new home designs.

Bureau of Indian Affairs (BIA)

BIA’s Housing Improvement Program (HIP) funded the construction of a demonstration home in Summer 2016. The home, described in the Housing Design chapter of this report, was built by a construction crew from Newtok and contains systems for electricity and water/sewer that can function independent of village infrastructure and can be connected to larger grids when available.

HIP funding was also granted in 2011, which was used to build three homes in Mertarvik in 2012 that are currently occupied.

Housing and Urban Development (HUD)

The Village Council of Newtok applied for, and was awarded, a grant through the Indian Community Development Block Grant Program (ICDBG) Imminent Threat in 2014. The $900,000 grant provides funding to put infrastructure in place for a possible 12-home relocation from Newtok to Mertarvik. This grant is currently being amended, as the Village Council of Newtok withdrew their application for the 12-home relocation (see FEMA, below) and is amending it to fund an acquisition/demolition of up to 17 homes.
HUD’s Indian Housing Block Grant Village Allocation Program also provided funding for Mertarvik in 2006. The Village Council of Newtok used that funding to construct three homes in Mertarvik in 2007. The homes are occupied seasonally, and in need of renovation.

Federal Emergency Management Agency (FEMA)

After a storm on January 23, 2014 that was declared a federal disaster, the Village Council of Newtok worked with the Alaska Division of Homeland Security and Emergency Management to apply for a Hazard Mitigation Grant from FEMA. An estimated $2.7 million was allocated for the relocation of 12 homes that were deemed structurally sound enough to make the move to Mertarvik. However, the Newtok Village Council requested to withdraw their application for the home relocation in October 2016. As of January 2017, they are exercising an option to amend the application to fund an acquisition/demolition of a potential 17 homes instead of the original 12-home relocation.

Federal funding sources

Federal funding for housing and infrastructure is available through three main agencies: the Bureau of Indian Affairs (BIA), the Department of Housing and Urban Development (HUD) and the Department of Agriculture Rural Development office (USDA RD). These agencies have funding available through grant and loan programs. While some programs offer funding on an annual basis, others are ongoing. Funding is available both for Tribes and individuals.

Bureau of Indian Affairs (BIA)

BIA’s Housing Improvement Program is a funding mechanism for Tribes to repair existing housing and provide new housing. This program has funded 3 homes built in Mertarvik in 2012 and one home in 2016.

Housing Improvement Program (HIP)

**Eligibility:** American Indians or Alaska Natives who cannot qualify for housing assistance from another source. Applicants must live in a tribal service area.

**Description:** This program provides grants to Tribes for repairing, renovating, or replacing existing housing and for providing for new housing. The purpose of the program is to promote stability and security for Indian families. The selection of the grantees is determined by a screening process that assigns points to specific ranking factors, such as income level, living conditions, and disability. Funding is provided in four different categories:

A: Emergency repair.
B: Renovation that will bring homes up to standard.
C: Home replacement or new homes.
D: Mortgage buy-down program that leverages other loans such as USDA Rural Development, HUD Section 184, Community Development Financial Institutions, and VA loans, among others.

**Timeline:** Annual application. However, existing applications only require an annual update to remain eligible for up to four years.

**Regulations:** 25 CFR 256. These were just revised in December 2015.

**Next steps:** To receive funding from this program, tribes must submit an Annual Performance Review to the BIA. Then Alaskan Native Villages can contact the Housing Program Specialist at the Alaska regional office of Indian Affairs for more information about applying to the program.
U.S. Department of Housing and Urban Development (HUD)

HUD has multiple programs that fund housing and related infrastructure. Block grant programs provide funding to Tribes for community projects and other programs offer loans for Tribes and individuals.

Indian Community Development Block Grant Program (ICDBG)

**Eligibility:** Indian tribes, bands, groups, nations, or Alaska Native Villages with an established relationship to the Federal government. In some cases, tribal organizations may apply to the program.

**Description:** This program provides direct grants for use in developing viable Indian and Alaska Native Communities. Funding can be used for housing (rehabilitation, land acquisition, new housing construction), community facilities, and economic development (commercial, industrial, and agricultural projects). There are two types of grants: single-purpose grants are competitively awarded and provide funds for activities designed to meet a specific community development need; and imminent threat grants address urgent problems that were not evident during the grant funding cycle or that require immediate action.

**Timeline:** An annual Notice of Funding Availability (NOFA) is published each year for single-purpose grants. Grants are awarded on a competitive basis to applicants. Imminent Threat grants are awarded on a first-come-first-serve basis to mitigate immediate threats to health and safety.

**Regulations:** Tribes must comply with nondiscrimination provisions and not have outstanding ICDBG financial obligations to HUD in arrears or not having an agreed-upon repayment schedule. Single purpose grants must primarily benefit low- and moderate-income persons. There are also program-specific regulations. Finally, Tribes need to be prepared to submit documentation of the community development need to be addressed, and documentation that the project will benefit the neediest segment of the population. The documentation should include quantitative data from sources such as community surveys, existing programs, or data from other agencies. It may also include Census or other demographic data.

**Next steps:** This grant can be used for land development in addition to housing. To learn more about the grants and how to apply for them, contact the Alaska ONAP staff.

Indian Housing Block Grant (IHBG)

**Eligibility:** Federally recognized Indian tribes or their tribally designated housing entity.

**Description:** This program is authorized under the Native American Housing Assistance and Self Determination Act of 1996 (NAHASDA). It is a formula-based grant program administered in Southwest Alaska by the Alaska ONAP office and AVCP Housing. The grants can be used for a range of housing activities, such as housing development, assistance to housing that was developed under the Indian Housing Program, housing services to eligible households, crime prevention and safety, and model activities that provide creative approaches to solving affordable housing problems. This funding is allocated to the regional housing authority (AVCP RHA), which typically uses it among its member villages in a rotating fashion.

**Timeline:** Annual

**Regulations:** To be eligible for funding, Tribes must submit an Indian Housing Plan to HUD each year. Then, at the end of the year, recipients of the grant must submit an Annual Performance Report that documents their progress toward goals listed in their Indian Housing Plan.

**Next steps:** Currently, Newtok is not in rotation for the Indian Housing Block Grant Program because of the upcoming move to Mertarvik. Once infrastructure is in place in Mertarvik, AVCP Housing Authority will allocate IHBG to build homes at the new site. For more information, contact AVCP Housing staff.

Title VI Loan Guarantee

**Eligibility:** Federally recognized Indian tribes or their tribally designated housing entity.

**Description:** This program is authorized under the Native American Housing Assistance and Self Determination Act of 1996 (NAHASDA). It is administered by the Alaska ONAP office and AVCP Housing. The program provides financing guarantees to Indian tribes for private market loans to develop affordable housing. Eligible activities include creating new housing, rehabilitating housing, constructing community facilities, acquiring land for housing, preparing architectural and engineering plans, and financing costs. In Alaska, the program has been used to build modular housing units in Mountain Village and single-family units in Unalakleet, Kobuk, and Shungnak. The program is very flexible, and Tribes can structure their loan with various terms, interest rates, and payment schedule.

**Timeline:** Applications are accepted year-round.

**Regulations:** The Tribe pledges the need portion of the annual IHBG and the project’s income as security
to HUD in exchange for the loan guarantee. The maximum guarantee amount that the Tribe can borrow is approximately five times the need portion. This total applies to the sum of the Title VI loans taken out by the Tribe. The Tribe will need to repay the Title VI loan but can use IHBG funds to do so. **Next steps:** More information is available on the [program web page](#). Interested Tribes in Southwest Alaska should contact [Alaska ONAP staff](#) and [AVCP Housing staff](#) for more information.

Section 184 Indian Home Loan Guarantee Program

**Eligibility:** American Indians, Alaska Natives, Alaska Villages, Tribes, or Tribally Designated Housing Entities

**Description:** This program, administered by the Alaska ONAP office, guarantees home loans for new construction, rehabilitation or purchase of existing homes, or refinancing. Banks are provided with a 100% guarantee for the loans, thus encouraging them to lend to Native individuals and communities. The mortgages can be used on and off native lands for new construction, rehabilitation, the purchase of a new home, or refinancing.

**Timeline:** Applications are accepted year-round.

**Regulations:** Applicants must be credit-qualified and Native American. The program can be used anywhere in the State of Alaska.

**Next steps:** Visit the [program website](#) for more information and contact [Alaska ONAP staff](#) for assistance in applying.

United States Department of Agriculture Rural Development (USDA RD)

USDA RD has multiple programs that fund housing and infrastructure in rural areas. Programs include grants to organizations and villages and loan options for individuals. All programs are administered through the Alaska USDA RD office.

Mutual Self-Help Housing Technical Assistance Grants

**Eligibility:** Government nonprofit organizations, federally recognized Tribes, private nonprofit organizations

**Description:** This program provides grants to organizations to organize and conduct local self-help housing construction projects. Very-low- and low-income individuals construct their own homes as a group, with technical assistance from the organization overseeing the project.

**Timeline:** Applications are accepted year-round.

**Regulations:** Funds may be used for technical and supervisory assistance, to help other organizations provide technical and supervisory assistance, to help families complete loan applications and other activities that will boost participation in the program. Funds may not be used to hire people to perform construction work, buy real estate or building materials, pay debts or expenses for participants, pay for employee training, or pay indirect costs. This program is governed by 7 CFR 1944-1.

**Next steps:** More information is available on the [program web page](#), and interested organizations should contact the [Single Family Housing and Communities Facilities](#) department of the Alaska USDA RD office.

Single Family Housing Guaranteed Loan (Section 502 Guaranteed Loan Program)

**Eligibility:** Low- and moderate-income households who will occupy the dwelling as their primary residence. Applicants must be U.S. citizens, U.S. non-citizen nationals, or Qualified Aliens and have the legal capacity to incur a loan obligation. The homes must be in eligible rural areas.

**Description:** This program helps lenders provide rural low- to moderate-income homebuyers with loans. It provides a 90% loan guarantee to approved lenders to reduce the risk of extending loans for new or existing residences in rural areas.

**Timeline:** Applications are accepted year-round.

**Regulations:** The loans can be used for new or existing residential property. The loan amount can include a number of different accessories to the actual property, such as closing costs for the purchase, repairs to existing structures, insurance premiums, essential household equipment, energy efficient features, and site preparation costs. Finally, loans must come from an approved lender. The program is governed by 7 CFR, Part 355.**

**Next steps:** Interested families start with an approved lender, and should ask the loan officer about applying for this [program](#). General questions can also be directed to the USDA RD Alaska [Guaranteed Rural Housing Loan Specialist](#).
Single Family Housing Direct Home Loan (Section 502 Direct Loan Program)

**Eligibility:** Low-income households in eligible rural areas may apply for the program if they are planning to occupy the home as their primary residence, are willing and able to repay debt, meet citizenship requirements, and are unable to obtain a loan from other resources.

**Description:** This program provides assistance to applicants to reduce their mortgage payment. The goal of the program is to help low-income rural residents obtain safe and sanitary housing. The amount of assistance is determined by the adjusted family income. Also, people who borrow through the program will have zero down payment and are not required to carry private mortgage insurance. The program also offers low, fixed-interest rates (as low as 1% after the payment assistance) and up to a 38-year payback period.

**Timeline:** Applications are accepted year-round.

**Regulations:** Homes financed through this program must be moderate in size and contain no in-ground swimming pools or incoming-producing activities. The market value of the home has to be under a certain amount. The loan can be used for new or existing properties. In addition to covering the cost of buying or building a residence, funds can be used to repair structures, prepare sites, or provide water and sewage facilities. This program is governed by 7 CFR, Part 3550.

**Next steps:** More information is available on the [program web page](#) and interested organizations can contact the Single Family Housing and Community Facilities department of the Alaska USDA RD office.

Single Family Repair Loans and Grants (Section 504 Home Repair Program)

**Eligibility:** Low-income households in eligible rural areas may apply for the program. They must be occupying the home as their primary residence, be willing and able to repay debt, meet citizenship requirements, and be unable to obtain a loan or grant from other resources.

**Description:** This program provides loans to very-low-income families to repair, improve, or modernize their existing homes. The loans have a maximum amount of $20,000, and offer up to 20 year terms at 1% interest. The program also provides grants to elderly very-low-income homeowners to remove health and safety hazards in their home. Some examples of eligible repairs for the loans and grants include roof replacement, winterization, purchasing or repairing a heating system, structural repairs, and water/sewer connection work.

**Timeline:** Applications are accepted year-round and are processed in the order that they are received.

**Regulations:** Homeowners must have a family income below 50% of the area median income. For grants, applicants must be age 62 or older. This program is governed by 7 CFR, Part 3550.

**Next steps:** More information is available on the [program web page](#), and interested organizations should contact the Single Family Housing and Community Facilities department of the Alaska USDA RD office.

Rural Housing Site Development Loans

**Eligibility:** Private or public non-profit organizations and Federally-recognized Tribes.

**Description:** This program offers two types of loans, Section 523 and Section 524 loans, to purchase and develop housing sites for low- and moderate-income families. The Section 523 loans can be used for housing that is constructed by the Self-Help method. The Section 524 loans have no restrictions as to the method of construction.

**Timeline:** Applications are accepted year-round.

**Regulations:** The loans have a 2-year term. Section 523 loans have 3% interest rate and Section 524 loans are at market rate. Housing must be for low-income (50-80% of AMI) or moderate-income ($5,500 above the low-income limit) families. Housing must be located in an eligible rural area. This program is governed by RD instructions 1924-A and 1924-C.

**Next steps:** More information is available on the [program web page](#), and interested organizations should contact the Single Family Housing and Community Facilities department of the Alaska USDA RD office.

Rural Alaska Village Grants

**Eligibility:** Rural Alaska Native villages; ANTHC can also apply on behalf of a rural Alaska village.

**Description:** This program funds the planning, development, and construction of water and wastewater systems to improve health and sanitation conditions in rural Alaska. Installed systems vary, and can include piped water
and sewer systems, wells, tank haul systems, washeterias, septic systems, and plumbing in homes. Villages can also use funds for technical assistance and training. Grants will cover 75% of project costs; the remaining 25% need to come from the State of Alaska.

**Timeline:** There are specific application openings each year; times fluctuate. It is announced on the State of Alaska website.

**Regulations:** Villages must have a population of less than 10,000, and the area median income cannot exceed 110% of the State metropolitan median income. Also, there must be a dire sanitation condition.

**Next steps:** The first consideration is the need for a 25% match for any of the grants. The community of Newtok can work with their main contact at ANTHC to apply to the State of Alaska for the matching funds. They will then need a planning project first, to get an engineering report and environmental assessment to use for infrastructure projects. There have already been initial talks between USDA and ANTHC about putting Newtok in for a planning project to get those required documents. Questions about the program can be directed to the [Director of Water and Environmental Programs](#) at the Alaska USDA RD office.

**Water and Waste Disposal Loans and Grants**

**Eligibility:** State and local government entities, private nonprofits, and Federally-recognized Tribes

**Description:** This program provides funding for clean and reliable drinking water systems, sanitary sewage disposal, sanitary solid waste disposal, and storm water drainage. Most funding is in the form of long-term low-interest loans; if funds are available, some funding may be in the form of a grant combined with a loan to keep interest payments reasonable. Loan terms are up to 40 years, and have a fixed interest rate based on the project need and the area median household income.

**Timeline:** Applications are accepted year-round.

**Regulations:** Projects must be located in rural areas or towns with fewer than 10,000 people or Tribal lands in rural areas. A match is required. This program is governed by 7 CFR, Parts 1780 and 1782.

**Next steps:** The first step is to talk with the [Director of Water and Environmental Programs](#) at the Alaska USDA RD office for more information, loan requirements, and help identifying potential projects.

**Water and Waste Disposal Loan Guarantees**

**Eligibility:** State and local government entities, private nonprofits, and Federally-recognized Tribes may apply for loans through a private lender. The private lender applies for the loan guarantee.

**Description:** This program helps private lenders provide affordable loans to borrowers to finance projects to improve access to clean, reliable water and waste disposal systems for households and businesses in rural areas. For example, loans could be used to construct or improve facilities for drinking water, sanitary sewers, solid waste disposal, and storm water disposal facilities. The maximum guarantee is typically 90% of the loan amount, and interest rates can be fixed or variable. Loan terms can be up to 40 years.

**Timeline:** Applications are accepted year round.

**Regulations:** Projects must be located in rural areas or towns with fewer than 10,000 people or Tribal lands in rural areas. Facilities constructed through the program must be used for public purposes. This program is governed by 7 CFR, Part 1779.

**Next steps:** This program comes through an approved lender, so the first step is contacting a lender of choice to discuss the proposed project and apply to the program for the loan guarantee. General questions about the program can be directed to the [Director of Water and Environmental Programs](#) at the Alaska USDA RD office.

**Solid Waste Management Grants**

**Eligibility:** State and local government entities, private nonprofits, academic institutions, and Federally-recognized Tribes

**Description:** This program helps reduce or eliminate pollution of water resources by funding projects that provide technical assistance or training to improve the planning and management of solid waste sites. For instance, an evaluation of current landfill conditions or training to help communities reduce solid waste or close landfill sites. The program provides funds in the form of competitive grants.

**Timeline:** Applications are accepted through the Alaska USDA RD office each year from October 1 - December 31.

**Regulations:** Projects must be in a rural area or town with 10,000 or fewer people. Special consideration may
be given for areas with smaller populations or lower income populations. This program is governed by 7 CFR 1775 Subpart D. **Next steps:** This program is not for infrastructure. It will fund training for community members or landfill operators. There are other training programs as well, so a first step is to contact the Director of Water and Environmental Programs at the Alaska USDA RD office. If the Newtok Village Council has training related to solid waste that they would like to fund, the director can either help with an application to this program, or with ideas for other funding sources that may be more applicable.

**State funding sources**

Funding for housing and infrastructure projects is available through the State of Alaska. The Alaska Housing Finance Corporation (AHFC) offers grants, loans, and education for housing projects and individual home buyers. The Association of Alaska Housing Authorities also offers training and technical assistance to communities.

**Alaska Housing Finance Corporation (AHFC)**

AHFC’s mission is to provide Alaskans with access to safe, quality, affordable housing. As part of that goal, AHFC offers loans and grants to individuals, regional housing authorities, and other organizations.

**Supplemental Housing Development Grant Program**

**Eligibility:** Regional Housing Authorities can apply for funding to supplement housing projects that have been approved for development by HUD.

**Description:** This program began in 1981 with the goal of promoting energy efficiency in rural housing. The funds from the program can be used to build energy efficient homes or rehabilitate existing housing units.

**Timeline:** Annual, NOFA typically issued by AHFC in late summer.

**Regulations:** Funds are limited to 20% of HUD’s total development cost per project, and can only be used for the following: on-site sewer and water facilities, road construction to project sites, electrical distribution facilities, and energy efficient design features in homes. To qualify, homes must meet the current Alaska BEES.

**Next steps:** The Newtok Village Council must work with the Housing Planning Manager at AVCP Regional Housing Authority and provide them as much information as possible on the urgency of the situation and the work plan for the move. Then AVCP RHA can include tasks for Newtok in its annual application to the program.

**Teacher, Health Professional, and Public Safety Housing Program (THHP)**

**Eligibility:** School districts, local governments, regional health corporations, housing authorities, and nonprofits.

**Description:** This program provides funding for rental housing for essential workers in rural Alaska. The goals are to improve housing conditions in small communities and reduce turnover of rural professionals. The program attempts to distribute funds equally throughout the geographic regions of Alaska and prioritizes energy efficient and safe housing projects.

**Timeline:** Annual, NOFA typically issued by AHFC to registries in summer.

**Regulations:** The rental housing must be occupied by teachers, health professionals, or public safety workers for a minimum of 10 years following its construction. To be competitive, projects should include match funding. Specific regulations for each year will be included in that year’s NOFA.

**Next steps:** To apply for this grant, the first step is to register with AHFC at the link above in the spring. All registrants will be invited to the application process. For more information and questions, entities can contact the program manager (contact information on this page).

**Rural Owner-Occupied and Non-Owner-Occupied Loan**

**Eligibility:** For the owner-occupied loan, residents of small communities. A small community has less than 6,500 people and is not connected by road or rail to Anchorage or Fairbanks. For the non-owner-occupied loan, the borrower can be an Alaska resident, local government entity, or regional attendance area.
**Description:** This program offers loan funding for rural housing through eligible lenders. The loan interest rate and terms are often more attractive than other loan programs in order to support residents in rural areas. In addition, these loans do not require mortgage insurance.

**Timeline:** Applications are accepted year-round.

**Regulations:** Borrowers must be residents of Alaska, and cannot be delinquent on child support. The home must be built to BEES standards, have proper inspections, and be built by licensed contractors with a residential endorsement. For the non-owner-occupied loan program, the property must be a duplex, triplex, or fourplex. In both cases, the interest rate will apply to the first $250,000 of the loan amount. Loans in excess of that amount receive a blended interest rate where the excess of $250,000 is calculated at the Rural Program rate plus 1%.

**Next steps:** The first step is to contact a lender of your choice and ask about AHFC interest rate reduction options (described below) that can be added onto this loan program.

**Interest Rate Reduction Options**

**Eligibility:** Qualified Alaskan borrowers can apply for the energy efficiency rate reduction.

**Description:** AHFC offers two interest rate reductions for borrowers: one for low-income borrowers who have not owned a primary residence within the last three years and another for borrowers who purchase a newly constructed energy efficient home, an existing energy efficient home, or one to which energy efficiency improvements will be made within 365 days from closing.

**Timeline:** Applications are accepted year-round.

**Regulations:** For the low-income borrowers rate reduction program, some exceptions apply. These include borrowers age 60 and older, borrowers who have suffered a significant reduction in income due to death or permanent disability of a family wage earner, and borrowers who have lost ownership in a primary residence due to divorce. Low-income borrowers also must participate in an approved homeowner education class. For the energy efficiency program, new or existing homes must be 5 Star Plus or 6 Star, or the borrower must make energy improvements within 365 days of closing. Borrowers must be residents of Alaska and cannot be delinquent on child support. The home must be built to BEES standards, have proper inspections, and be built by licensed contractors with a residential endorsement. Interest rate reductions apply to the first $200,000 of the loan amount for energy efficiency, and the first $180,000 of loans for low-income borrowers.

**Next steps:** Interested individuals should begin at their lender of choice and ask the loan officer about these options to reduce the interest rate.

**Affordable Housing Enhanced Loan Program (AHELP)**

**Eligibility:** Low- and moderate-income Alaskan borrowers

**Description:** This program is a partnership between AHFC and another agency (a housing authority, a housing organization, or an approved lender) to help AHFC provide safe, affordable housing to low- and moderate-income Alaskan borrowers. In this program, the borrower receives down payment assistance, closing cost assistance, or secondary financing from a local, state, or federal government agency, nonprofit agency, or regional housing authority. The assistance can come in the form of a grant, deferred payment option, a forgivable loan, or a combination of these options. In the past, Alaskan housing authorities and Neighborworks Alaska have collaborated with AHFC through this program. The program can provide a means to combine funding allocated for housing into a loan program, making loans more feasible for residents while also allowing the funding to reach more individuals.

**Timeline:** Programs can be set up at any time, and typically applications to them are accepted year-round.

**Regulations:** Different partners will have different regulations. However, AHFC requires that borrowers not own other residential property in the same general area, that the property be an owner-occupied single-family home, condominium, unit in a Common Interest Community, or Type I manufactured home. Also, borrowers must participate in an approved homebuyer education class.

**Next steps:** If an organization working on the move of Newtok to Mertarvik, such as the Newtok Village Council or AVCP Housing, would like to learn more about this program, start by contacting an AHFC lending officer.

**HomeChoice Class**

**Eligibility:** Anyone may take the course.

**Description:** HomeChoice is a free class for home buyers in Alaska. It covers many topics surrounding the
process of buying a home, including money management, AHFC loan programs, insurance, purchase and sale contracts, home inspections, and energy efficient features. Attendees are eligible for a $250 discount on closing costs for home loans financed through AHFC.

**Timeline:** Class schedules can be found on AHFC’s website. For rural citizens, contact the HomeChoice administrative assistant at AHFC to schedule a class for your area, or arrange for a home study option.

**Regulations:** Attendees must pass a quiz at the end of the class to be eligible for the discount on closing costs. For rural classes, there must be at least 5 participants.

**Next steps:** If Newtok residents would be interested in a class, contact the HomeChoice administrative assistant at AHFC. If possible, as much notice as possible is appreciated. Also, providing information about the specific community needs will allow the instructor to tailor the class to the particular location.

### Association of Alaska Housing Authorities (AAHA)

AAHA members consist of the fourteen Alaskan regional housing authorities and the Alaska Housing Finance Cooperation. Their Training and Technical Assistance Program funded this report, and is available to provide Tribes with skill-building training.

**Training and Technical Assistance Program**

**Eligibility:** Indian Housing Block recipients

**Description:** This program provides comprehensive training and/or technical assistance to organizations providing housing for Native Alaskans in order to build capacity and improve the effectiveness of Alaska’s housing programs. Services are provided free of charge and can include needs assessments, on-site or remote technical assistance, materials and tools that have been refined for Alaskan construction sites, and place-based trainings for groups.

**Timeline:** Applications are accepted year-round.

**Regulations:** Applicants must be a recipient of an Indian Housing Block Grant. The technical assistance will be provided by one of AAHA’s team of technical assistance and training providers.

**Next steps:** This program can provide construction training and residential endorsement classes for local building crews. The program website contains link to the electronic application, and contact information for questions.

### Other funding sources

Funding for housing projects is also available through nonprofit organizations and a national bank cooperative.

### Federal Home Loan Banks (FHLBanks)

FHLBanks is an organization made up of regional cooperatives of local banks. In addition to providing member institutions liquidity for financing, FHLBanks has an Affordable Housing Program (AHP) which provides funding for housing and community development projects. The AHP is administered through the regional FHLBanks offices.

**Affordable Housing Program (AHP) - Competitive Program**

**Eligibility:** Local developers, nonprofits, housing authorities, or community organizations that will build or renovate housing for low- to moderate-income households. Many projects are designed for seniors, the disabled, homeless populations, first-time homeowners and others with limited resources or special needs.

**Description:** This program, administered in Alaska by FHLBanks Des Moines, is a private source of funding up to $500,000 for financing and building affordable housing. It is funded through 10% of the FHLBanks’ net annual income. The program is run as a competitive grant program and was created in the Financial Institutions Reform, Recovery, and Enforcement Act of 1989. Grant applications are scored so that priority is given to projects that utilize the funding to create the greatest benefit.

**Timeline:** NOFA is issued annually, typically in June.

**Regulations:** There are income requirements for home recipients, which are set based on the HUD and/or NAHASDA income guidelines. Also, there is a limit for funding per house; in the past, $30,000 per house
has been allowed. There is a time limit for projects if funding is received. Rental projects are given 3 years to completion, and homeownership projects must be completed in 2 years.

**Next steps:** This program can be used for gap funding, to help with part of the funding necessary for building homes. If Newtok is considering applying to this program, the first step is to become familiar with the competitive scoring criteria. Each year’s criteria is published in January in an AHP Implementation Plan, which is available on the website above. After reading this, potential applicants are welcome to call the **Community Investment Department** at FHLBanks with questions and submit summaries of their planned work for feedback. Also, applicants will need to partner with a **member financial institution** to act as the conduit of grant funds.

### Affordable Housing Program - Down Payment Assistance

**Eligibility:** Potential homeowners; requirements differ by program, see below.

**Description:** Through this program, member banks can provide down payment and closing cost assistance to eligible local homeowners. Banks are then reimbursed up to $450,000 annually by the FHLB Des Moines office. The program’s goals are to help more families realize the dream of homeownership while helping member banks improve their relationship with the community. The program consist of three separate products:

1. **HomeStart** - Grants of up to $5,000 per household for down payment and closing cost assistance. Total annual household income may not exceed 80% of the area median income.

2. **HomeStart Plus** - Grants of up to $10,000 per household for down payment and closing cost assistance. Households must be the recipient of public housing assistance with the purchase of the home, and total household income may not exceed 80% of the area median income.

3. **Native American Homeownership Initiative** - Grants of up to $10,000 per household for down payment, closing cost, homeownership counseling, or home repairs. At least one of the adult members of the household must be an enrolled member of a Federally Recognized Tribe or a member or shareholder of an Alaska Village or Regional Corporation, and total household income may not exceed 80% of the area median income.

**Timeline:** This program is annual, with funds available on a first-come, first-served basis.

**Regulations:** Area median incomes are determined by HUD and should be adjusted for household size.

**Next steps:** **Down payment assistance** is processed through **member institutions**. Potential homeowners should contact a member bank of their choice and ask about the program.

### Neighborworks Alaska

Neighborworks Alaska is a nonprofit dedicated to improving the quality of life for Alaskans by strengthening neighborhoods and creating new housing opportunities. They offer two programs for rural areas:

**Homeowner Education**

**Eligibility:** First-time homebuyers and anyone interested in learning more about homeownership

**Description:** Neighborworks offers homeowner education via two different methods. First, they work with a funding partner to offer in-person homeowner classes. Second, Alaskans can access courses online via the Neighborworks website. In both cases, classes cover content based on national curriculum standards for homebuyer education, including topics such as financial planning, goals and investments, and home occupant responsibilities. In the past, rural classes have been sponsored by organizations such as housing authorities.

**Timeline:** People can access homeowner classes online at any time; in person classes must first be arranged by a community, funder, and Neighborworks Alaska.

**Regulations:** N/A

**Next steps:** Call Neighborworks Alaska’s **Director of Lending and Homeownership** to estimate costs of an **in-person class** and tailoring a program for Newtok.

**Home Ownership Services**

**Eligibility:** Each loan has differing regulations; loan options are described in this document in the sections corresponding to the funding agency.
**Description:** Neighborworks offers several programs to help potential homeowners finance a house. If an organization, Tribe, or Village Council has funding for a loan pool, Neighborworks can provide technical assistance in setting up a loan pool. The group also offers loan packaging and assistance for other loan programs, such as USDA, FHA, and AHFC loans. In either case, potential homeowners begin with one-on-one meetings (in person or on the telephone) with a housing counselor and then meet with a mortgage specialist to choose a program and apply for the loan.

**Timeline:** Varies. Individuals should begin with a homeowner education class and then proceed to housing counseling before working with a mortgage specialist.

**Regulations:** Varies depending on loan program.

**Next steps:** Contact Neighborworks Alaska’s Director of Lending and Homeownership, who will be able to assess which programs may best be able to help with building Mertarvik homes, and begin to facilitate housing counseling for individuals ready to start the process of homeownership.

**Rural Alaska Community Action Program, Inc. (RurAL CAP)**

RurAL CAP is a nonprofit organization that works to improve the quality of life for low-income Alaskans through a variety of programs. The Self-Help Housing program has the potential to be used in Mertarvik.

**Self-Help Housing**

**Eligibility:** Groups of 6-12 participants willing to work together to create a community of single-family homes. Participants must meet income requirements, including having a minimum credit score of 680 and cash income. Also, once in the program, they are required to work 30 hours per week building the homes.

**Description:** This program is a partnership between RurAL CAP, USDA Rural Development, and AHFC. Potential home buyers interested in the program go through a pre-screening process, and receive assistance in applying for USDA Section 502 loans. Then, if 6-12 families qualify for USDA's loan program, they are admitted to the program as a group. RurAL CAP provides assistance securing and developing a site for the group of homes. It also provides technical assistance during the construction phase. Overall, the program provides homeowners with new financial and technical skills, low-interest loans, and an opportunity to earn equity through working on the house construction.

**Timeline:** Applications are accepted at any time. There are typically two groups admitted every two years. Communities interested in the program can expect a 2-year lead time to develop the program for their area.

**Regulations:** Participants must pass a pre-screening application on income requirements and ability to work a minimum of 30 hours per week in building the homes.

**Next steps:** If the community of Newtok has a group of homeowners interested in this self-help program, begin by talking to Misty Barker of The Planning Workshop [mbarker@mtonline.net, 907-862-5199]. She has experience working with RurAL CAP and has formerly worked with this program. As the program is described above, it may not be the best fit for a rural location, as it typically has been implemented in more urban areas where the travel costs for the foreman and building materials are lower. However, Ms. Barker reported that there is a possibility of running this same type of program using funds other than USDA Rural Development loans. For instance, Indian Housing Block Grant or Indian Community Development Block Grant funding could be utilized to run the program with a slightly different structure. She would be able to speak to the Newtok Community about options that could adapt this program to their situation (M. Barker, personal communication, August 1, 2016). They also can contact the Planning and Construction Division at RurAL CAP for more information.
REFERENCES


MERTARVIK
Housing Master Plan
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APPENDIX A
Newtok Planning Group Participants

Participants in the Newtok Planning Group

Native Village of Newtok
- Newtok Village Council
- Newtok Native Corporation

State of Alaska
- Alaska Department of Commerce, Community, and Economic Development – group coordinator
- Alaska Department of Environmental Conservation (DEC)/Village Safe Water Program
- Alaska Department of Transportation and Public Facilities
- Alaska Department of Military and Veterans Affairs/Division of Homeland Security and Emergency Management
- Alaska Department of Education and Early Development
- Alaska Department of Health and Social Services
- Alaska Industrial Development and Export Authority/Alaska Energy Authority
- Alaska Governor’s Office
- Alaska Legislative Representatives:
  - Senator Lyman Hoffman’s Office
  - Representative Herron’s Office

Federal
- U.S. Army Corps of Engineers, Alaska District
- U.S. Department of Commerce, Economic Development Administration
- U.S. Department of Commerce, National Oceanic and Atmospheric Administration
- U.S. Department of Defense, Innovative Readiness Training Program
- U.S. Department of Agriculture, Rural Development
- U.S. Department of Agriculture, Natural Resources Conservation Services
- U.S Department of Housing and Urban Development
- U.S. Department of the Interior, Bureau of Indian Affairs
- U.S. Department of Transportation, Federal Aviation Administration
- U.S. Environmental Protection Agency
- Denali Commission
- Alaska Congressional Delegation
  - Senator Lisa Murkowski’s Office
  - Representative Don Young’s Office

Regional Organizations
- Association of Village Council Presidents, Regional Housing Authority
- Alaska Native Tribal Health Consortium
- Coastal Villages Region Fund
- Lower Kuskokwim School District
- Rural Alaska Community Action Program
- Yukon-Kuskokwim Health Corporation
What do you want your community to look like?

- What types of housing work for your family and your community?
- How many houses will be needed?
- How can the housing at the new site learn from, and build upon, traditional knowledge?
- What can be done to provide for our future generations?

CCHRC staff will be meeting with each household individually to talk with you about these very important topics.
APPENDIX C
Housing Needs Assessment Questions

Date_____________________________________

Name of household:_______________________________________________________

Address:_______________________________________________________________________

Interviewee name(s):___________________________________________________________

Interviewee relationship to head of household (circle one):

Self                               Spouse/partner

Elder (grandparent)                Child – biological

Child – foster                     Grandchild

Sibling                            Parent

Parent-in-law                      Son or daughter-in-law

Other relative                     Roomer or boarder

Housemate or roommate             Other non-relative
Population

Number of people living in the household year-round: _________________________________

Number of people living in the household year-round including seasonal occupants__________

Does any permanent resident of the household have a disability that requires a wheelchair or other disability access? (Circle one)

Yes            No
Household resident characteristics and income – FILL IN FOR EVERY ADULT. USE ADDITIONAL SHEET IF NECESSARY.

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<td>Elder,grandparent</td>
</tr>
<tr>
<td></td>
<td>Child – biological</td>
<td>Child – biological</td>
<td>Child – biological</td>
<td>Child – biological</td>
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<tr>
<td></td>
<td>Child – foster</td>
<td>Child – foster</td>
<td>Child – foster</td>
<td>Child – foster</td>
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<tr>
<td></td>
<td>Grandchild</td>
<td>Grandchild</td>
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<td>Grandchild</td>
</tr>
<tr>
<td></td>
<td>Sibling</td>
<td>Sibling</td>
<td>Sibling</td>
<td>Sibling</td>
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<tr>
<td></td>
<td>Parent</td>
<td>Parent</td>
<td>Parent</td>
<td>Parent</td>
</tr>
<tr>
<td></td>
<td>Other relative</td>
<td>Other relative</td>
<td>Other relative</td>
<td>Other relative</td>
</tr>
<tr>
<td></td>
<td>Roomer/boarder</td>
<td>Roomer/boarder</td>
<td>Roomer/boarder</td>
<td>Roomer/boarder</td>
</tr>
<tr>
<td></td>
<td>Housemate</td>
<td>Housemate</td>
<td>Housemate</td>
<td>Housemate</td>
</tr>
<tr>
<td></td>
<td>Other nonrelative</td>
<td>Other nonrelative</td>
<td>Other nonrelative</td>
<td>Other nonrelative</td>
</tr>
<tr>
<td><strong>Predominant race- circle one</strong></td>
<td>Alaska Native</td>
<td>Alaska Native</td>
<td>Alaska Native</td>
<td>Alaska Native</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>White</td>
<td>White</td>
<td>White</td>
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<tr>
<td></td>
<td>Black</td>
<td>Black</td>
<td>Black</td>
<td>Black</td>
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<tr>
<td></td>
<td>Hispanic</td>
<td>Hispanic</td>
<td>Hispanic</td>
<td>Hispanic</td>
</tr>
<tr>
<td></td>
<td>Asian</td>
<td>Asian</td>
<td>Asian</td>
<td>Asian</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
</tr>
<tr>
<td>If Alaska Native, are you a shareholder or descendent of a shareholder for any of the following regional corporations?</td>
<td>Circle one</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calista</td>
<td>Bristo Bay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bering Straits</td>
<td>Doyon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NANA</td>
<td>CIRI (Cook Inlet)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASRC (Arctic)</td>
<td>Slope</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aleut</td>
<td>Konig</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AHTNA</td>
<td>Chugach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sealaska</td>
<td>The 13th Regional</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monthly income in $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full time</td>
</tr>
<tr>
<td>Local/state/fed govn Construction Fishing/Cannery Retail Service Other</td>
</tr>
<tr>
<td>Part-time</td>
</tr>
<tr>
<td>Local/state/fed govn Construction Fishing/Cannery Retail Service Other</td>
</tr>
<tr>
<td>Seasonal</td>
</tr>
<tr>
<td>Local/state/fed govn Construction Fishing/Cannery Retail Service Other</td>
</tr>
<tr>
<td>Self-employed</td>
</tr>
<tr>
<td>Local/state/fed govn Construction Fishing/Cannery Retail Service Other</td>
</tr>
<tr>
<td>Unemployed Retired Subsistence</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Employment type and sector – circle all that apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full time</td>
</tr>
<tr>
<td>Local/state/fed govn Construction Fishing/Cannery Retail Service Other</td>
</tr>
<tr>
<td>Part-time</td>
</tr>
<tr>
<td>Local/state/fed govn Construction Fishing/Cannery Retail Service Other</td>
</tr>
<tr>
<td>Seasonal</td>
</tr>
<tr>
<td>Local/state/fed govn Construction Fishing/Cannery Retail Service Other</td>
</tr>
<tr>
<td>Self-employed</td>
</tr>
<tr>
<td>Local/state/fed govn Construction Fishing/Cannery Retail Service Other</td>
</tr>
<tr>
<td>Unemployed Retired Subsistence</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adult #1</th>
<th>Adult #2</th>
<th>Adult #3</th>
<th>Adult #4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calista</td>
<td>Bristo Bay</td>
<td>Bering Straits</td>
<td>Doyon</td>
</tr>
<tr>
<td>NANA</td>
<td>CIRI (Cook Inlet)</td>
<td>ASRC (Arctic)</td>
<td>Slope</td>
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<td>Aleut</td>
<td>Konig</td>
<td>AHTNA</td>
<td>Chugach</td>
</tr>
<tr>
<td>Sealaska</td>
<td>The 13th Regional</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other sources of income (circle all that apply)</td>
<td>Adult #1</td>
<td>Adult #2</td>
<td>Adult #3</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
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<td>---------</td>
</tr>
<tr>
<td>Retirement</td>
<td>Retirement</td>
<td>Retirement</td>
<td>Retirement</td>
</tr>
<tr>
<td>Pension</td>
<td>Pension</td>
<td>Pension</td>
<td>Pension</td>
</tr>
<tr>
<td>Rental income</td>
<td>Rental income</td>
<td>Rental income</td>
<td>Rental income</td>
</tr>
<tr>
<td>Interest</td>
<td>Interest</td>
<td>Interest</td>
<td>Interest</td>
</tr>
<tr>
<td>Estates</td>
<td>Estates</td>
<td>Estates</td>
<td>Estates</td>
</tr>
<tr>
<td>Trust income</td>
<td>Trust income</td>
<td>Trust income</td>
<td>Trust income</td>
</tr>
<tr>
<td>Dividends (PFD, Native Corp, etc)</td>
<td>Dividends (PFD, Native Corp, etc)</td>
<td>Dividends (PFD, Native Corp, etc)</td>
<td>Dividends (PFD, Native Corp, etc)</td>
</tr>
<tr>
<td>Unemployment</td>
<td>Unemployment</td>
<td>Unemployment</td>
<td>Unemployment</td>
</tr>
<tr>
<td>Social security (includes retirement, supplemental (SSI), disability)</td>
<td>Social security (includes retirement, supplemental (SSI), disability)</td>
<td>Social security (includes retirement, supplemental (SSI), disability)</td>
<td>Social security (includes retirement, supplemental (SSI), disability)</td>
</tr>
<tr>
<td>Public assistance (includes SNAP, WIC, TANF)</td>
<td>Public assistance (includes SNAP, WIC, TANF)</td>
<td>Public assistance (includes SNAP, WIC, TANF)</td>
<td>Public assistance (includes SNAP, WIC, TANF)</td>
</tr>
<tr>
<td>Veterans assistance</td>
<td>Veterans assistance</td>
<td>Veterans assistance</td>
<td>Veterans assistance</td>
</tr>
<tr>
<td>Foster care funds</td>
<td>Foster care funds</td>
<td>Foster care funds</td>
<td>Foster care funds</td>
</tr>
<tr>
<td>Child support</td>
<td>Child support</td>
<td>Child support</td>
<td>Child support</td>
</tr>
<tr>
<td>Alimony</td>
<td>Alimony</td>
<td>Alimony</td>
<td>Alimony</td>
</tr>
<tr>
<td>Other</td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
</tr>
</tbody>
</table>
Newtok housing characteristics

Is this one of the 12 homes to be relocated to Mertarvik by FEMA? (Circle one)
Yes  No

Which best describes this building? (Circle one)
Single family residence
Duplex
Building with more than 2 apartments
Mobile home
Boat, RV, van, etc.
Other

What is the approximate size of this building in square feet?____________________________

About when was this building built? (Circle one)
2010 or later
2000-2010
1990-1999
1980-1989
Before 1980

What year did the head of household move into this building? _________________

How many separate rooms are in this building? Do not count bathrooms, utility rooms, halls.________

How many bathrooms are in this building? Must be a separate room. _____________________

How many bedrooms are in this building? (efficiency style = 0)____________________
Are there living areas other than bedrooms that are used as a sleeping area at night? (Circle one)

Yes      No

IF YES, how many ____________________________

Circle what the building has:

Hot and cold running water
Flush toilet (flush and haul)
Flush toilet (piped water and sewer)
Bathtub or shower
Steamhouse
Electricity
Sink with a faucet
Electric stove or range
Gas stove or range
Refrigerator
Telephone service (include cell phones)
Passive ventilation (fresh 80s)
Mechanical ventilation (bathroom fans)
Mechanical ventilation (HRV)

What is the condition of this building? (Circle one)

Good
Needs minor repairs
Needs major rehabilitation
Circle all problems with this house.

No repairs needed

Roof leaks and needs repaired or replaced

Insulation in the ceiling is poor or nonexistent

There are holes in the floor

Insulation in the pipes is poor (cold floor)

Frozen pipes in winter

Porch and/or steps need repair

Plumbing leaks (bathroom and/or kitchen)

Windows and/or doors are broken (include cracks, drafty, and those that do not open)

Cracks in the wall or ceiling

Insulation in the walls is poor

There is fire/smoke damage to portions of the building

Foundation is bad

Mold on walls or rotting walls

Electrical outlets do not work

Other repairs needed

Does this building have a wheel chair ramp attached to the house? (Circle one)

Yes  No
**Newtok housing financing**

Is this building...? (Circle one)

*Owned by someone in the household with a mortgage or loan?*

*Owned by someone in the household without a mortgage or loan?*

*A Mutual Help home?*

*Rented?*

*Occupied without payment of rent?*

*Other?*

**IF RENTED**

Who owns the building? (Circle one)

*Landlord (resident of Newtok)*

*Landlord (not a resident of Newtok)*

*Other*

What is the monthly rent? ____________________________

Who pays the rent? (Circle one)

*Members of the household pay all the rent*

*Members of the household pay a portion of the rent and a portion is subsidized by__________*

**IF OWNED**

Does any member of the household have a mortgage, deed of trust, contract to purchase, or similar debt on this property? (Circle one)

*Yes*

*No*

Do you pay all of the mortgage/loan amount? (Circle one)

*Yes*
No, a portion is paid by ______________________

Are you required to pay fire, hazard, flood insurance on this property? (Circle one)

Yes  No

Are you required to pay real estate taxes on this property? (Circle one)

Yes  No

**Newtok housing utilities**

What is the primary fuel used for heating this building? (Circle one)

*Fuel oil or kerosene*

*Wood*

*Coal*

*Electricity*

*Gas*

*Wind*

*Solar*

*Other*

What is the secondary fuel used for heating this building?

*Fuel oil or kerosene*

*Wood*

*Coal*

*Electricity*

*Gas*

*Wind*

*Solar*

*Other*
Do you pay for heating fuel separate from your rent or mortgage payment? (Circle one)
Yes  No

Do you pay for electricity separate from your rent or mortgage payment? (Circle one)
Yes  No

Do you pay for water and sewer separate from your rent or mortgage payment? (Circle one)
Yes  No

Do you pay all of the utilities or is there a subsidy?
Yes  No, it is subsidized by ________________________________

Mertarvik housing number and type

Do you know any former Newtok families who are considering returning to Mertarvik and would require housing? How many? (Include names to avoid double counting)

0. No families

1. ___________________________________________________________________

2. ___________________________________________________________________

3. ___________________________________________________________________

4. ___________________________________________________________________

5. ___________________________________________________________________

6. ___________________________________________________________________

7. ___________________________________________________________________

8. ___________________________________________________________________
How many housing units in Mertarvik would the current household prefer to live in?

For each house **WITH ELDERS** answer the following:

<table>
<thead>
<tr>
<th>What type of housing is preferred?</th>
<th>House #1</th>
<th>House #2</th>
<th>House #3</th>
<th>House #4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single family detached house (elder living alone or with spouse)</td>
<td>Single family detached house (elder living alone or with spouse)</td>
<td>Single family detached house (elder living alone or with spouse)</td>
<td>Single family detached house (elder living alone or with spouse)</td>
<td>Single family detached house (elder living alone or with spouse)</td>
</tr>
<tr>
<td>Single family detached house (with caretaker)</td>
<td>Single family detached house (with caretaker)</td>
<td>Single family detached house (with caretaker)</td>
<td>Single family detached house (with caretaker)</td>
<td>Single family detached house (with caretaker)</td>
</tr>
<tr>
<td>Single family detached house (with relatives)</td>
<td>Single family detached house (with relatives)</td>
<td>Single family detached house (with relatives)</td>
<td>Single family detached house (with relatives)</td>
<td>Single family detached house (with relatives)</td>
</tr>
<tr>
<td>Apartment-style housing unit (elder living alone or with spouse)</td>
<td>Apartment-style housing unit (elder living alone or with spouse)</td>
<td>Apartment-style housing unit (elder living alone or with spouse)</td>
<td>Apartment-style housing unit (elder living alone or with spouse)</td>
<td>Apartment-style housing unit (elder living alone or with spouse)</td>
</tr>
<tr>
<td>Apartment-style housing unit (with caretaker)</td>
<td>Apartment-style housing unit (with caretaker)</td>
<td>Apartment-style housing unit (with caretaker)</td>
<td>Apartment-style housing unit (with caretaker)</td>
<td>Apartment-style housing unit (with caretaker)</td>
</tr>
<tr>
<td>Apartment-style (with relatives)</td>
<td>Apartment-style (with relatives)</td>
<td>Apartment-style (with relatives)</td>
<td>Apartment-style (with relatives)</td>
<td>Apartment-style (with relatives)</td>
</tr>
</tbody>
</table>

<p>| How many bedrooms would the family prefer? | | | | |
| How many bathrooms would the family prefer? | | | | |</p>
<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Would anyone require the house to be ADA compliant?</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>What fuel is preferred for heating? (Circle all that would be preferred)</td>
<td>Fuel oil/kerosene Wood Coal Electricity Gas Wind Solar Other</td>
<td>Fuel oil/kerosene Wood Coal Electricity Gas Wind Solar Other</td>
<td>Fuel oil/kerosene Wood Coal Electricity Gas Wind Solar Other</td>
<td>Fuel oil/kerosene Wood Coal Electricity Gas Wind Solar Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What plumbing options are preferred? (Circle all that would be preferred)</td>
<td>Running hot and cold water Bathroom with toilet Bathtub and shower Laundry room Steam house</td>
<td>Running hot and cold water Bathroom with toilet Bathtub and shower Laundry room Steam house</td>
<td>Running hot and cold water Bathroom with toilet Bathtub and shower Laundry room Steam house</td>
<td>Running hot and cold water Bathroom with toilet Bathtub and shower Laundry room Steam house</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How would the family prefer the home to be financed? (Circle one)</td>
<td>Own – pay for up front Own – pay for with mortgage or loan Rent Other:</td>
<td>Own – pay for up front Own – pay for with mortgage or loan Rent Other:</td>
<td>Own – pay for up front Own – pay for with mortgage or loan Rent Other:</td>
<td>Own – pay for up front Own – pay for with mortgage or loan Rent Other:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**If RENT above, would the family be willing to finance with a loan if a home with rent is not available in a timely fashion?**

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**How many adults would be willing to participate in the construction of the home?**

<table>
<thead>
<tr>
<th></th>
<th>Paid only?</th>
<th>Paid only?</th>
<th>Paid only?</th>
<th>Paid only?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Volunteer or pay?</td>
<td>Volunteer or pay?</td>
<td>Volunteer or pay?</td>
<td>Volunteer or pay?</td>
</tr>
</tbody>
</table>

**How many adults would be willing to participate in construction training for building homes?**

<table>
<thead>
<tr>
<th></th>
<th>Paid only?</th>
<th>Paid only?</th>
<th>Paid only?</th>
<th>Paid only?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Volunteer or pay?</td>
<td>Volunteer or pay?</td>
<td>Volunteer or pay?</td>
<td>Volunteer or pay?</td>
</tr>
</tbody>
</table>
For each house **WITHOUT ELDERS** answer the following:

<table>
<thead>
<tr>
<th></th>
<th>House #1</th>
<th>House #2</th>
<th>House #3</th>
<th>House #4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What type of housing is preferred?</strong></td>
<td>Single family detached house</td>
<td>Single family detached house</td>
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<td>Single family detached house</td>
</tr>
<tr>
<td></td>
<td>Apartment-style housing unit</td>
<td>Apartment-style housing unit</td>
<td>Apartment-style housing unit</td>
<td>Apartment-style housing unit</td>
</tr>
<tr>
<td><strong>How many bedrooms would the family prefer?</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Would anyone require the house to be ADA compliant?</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>What fuel is preferred for heating?</strong></td>
<td>Fuel oil/kerosene</td>
<td>Fuel oil/kerosene</td>
<td>Fuel oil/kerosene</td>
<td>Fuel oil/kerosene</td>
</tr>
<tr>
<td></td>
<td>Wood</td>
<td>Wood</td>
<td>Wood</td>
<td>Wood</td>
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<tr>
<td></td>
<td>Coal</td>
<td>Coal</td>
<td>Coal</td>
<td>Coal</td>
</tr>
<tr>
<td></td>
<td>Electricity</td>
<td>Electricity</td>
<td>Electricity</td>
<td>Electricity</td>
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<td></td>
<td>Gas</td>
<td>Gas</td>
<td>Gas</td>
<td>Gas</td>
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<td></td>
<td>Wind</td>
<td>Wind</td>
<td>Wind</td>
<td>Wind</td>
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<td></td>
<td>Solar</td>
<td>Solar</td>
<td>Solar</td>
<td>Solar</td>
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<tr>
<td></td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
</tr>
<tr>
<td><strong>What plumbing options are preferred? Circle all that would be preferred</strong></td>
<td>Running hot and cold water</td>
<td>Running hot and cold water</td>
<td>Running hot and cold water</td>
<td>Running hot and cold water</td>
</tr>
<tr>
<td></td>
<td>Bathroom with toilet</td>
<td>Bathroom with toilet</td>
<td>Bathroom with toilet</td>
<td>Bathroom with toilet</td>
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<tr>
<td></td>
<td>Bathtub and shower</td>
<td>Bathtub and shower</td>
<td>Bathtub and shower</td>
<td>Bathtub and shower</td>
</tr>
<tr>
<td></td>
<td>Laundry room</td>
<td>Laundry room</td>
<td>Laundry room</td>
<td>Laundry room</td>
</tr>
<tr>
<td></td>
<td>Steam house</td>
<td>Steam house</td>
<td>Steam house</td>
<td>Steam house</td>
</tr>
</tbody>
</table>

Cold Climate Housing Research Center

www.cchrc.org Mertarvik Housing Master Plan
<table>
<thead>
<tr>
<th>How would the family prefer the home to be financed? (Circle one)</th>
<th>Own – pay for up front</th>
<th>Own – pay for with mortgage or loan</th>
<th>Rent</th>
<th>Other:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own – pay for up front</td>
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<td>Rent</td>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td>Rent</td>
<td>Rent</td>
<td>Other:</td>
<td></td>
<td></td>
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<tr>
<td>Other:</td>
<td>Other:</td>
<td>Other:</td>
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</tbody>
</table>

If RENT above, would the family be willing to finance with a loan if a home with rent is not available in a timely fashion?

| Yes | Yes | Yes | Yes |
| No | No | No | No |

How many adults would be willing to participate in the construction of the home?

<table>
<thead>
<tr>
<th>Paid only?</th>
<th>Volunteer or pay?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paid only?</td>
<td>Volunteer or pay?</td>
</tr>
<tr>
<td>Paid only?</td>
<td>Volunteer or pay?</td>
</tr>
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</table>

How many adults would be willing to participate in construction training for building homes?

<table>
<thead>
<tr>
<th>Paid only?</th>
<th>Volunteer or pay?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paid only?</td>
<td>Volunteer or pay?</td>
</tr>
<tr>
<td>Paid only?</td>
<td>Volunteer or pay?</td>
</tr>
<tr>
<td>Paid only?</td>
<td>Volunteer or pay?</td>
</tr>
</tbody>
</table>
Polyurethane spray applied foam is a high performance insulation that must be applied strictly according to manufacturer’s specifications. Different manufacturers may have different application criteria. Any contractor applying a particular brand of foam must be trained by the manufacturer, or a factory authorized representative, in the handling and application of that product. All individuals who are working with or around spray applied polyurethane foam insulation during installation and initial curing must be knowledgeable of product characteristics such as curing times, exposure times, and safety precautions as specified by the product manufacturer. Additionally, the equipment used to mix and apply spray applied polyurethane foam insulation must meet manufacturer application specifications for that product. Performance of spray foam insulation must be applied at temperatures and against surfaces whose temperatures meet manufacturer specifications. Failure to comply with any of the above mentioned criteria may result in a defective installation that potentially undermines the insulation performance and may create indoor air problems for the home occupants.
NOTES

ADJUSTABLE SADDLE BRACKET MECHANICALLY FASTENED TO TRIODETIC FOUNDATION FOR
CONNECTION WITH GLULAM BEAM

FOUNDATION TO BE CONSTRUCTED ON LEVEL, DURABASE MATERIAL ABOVE GRADE
FOR TRANSPORT TO NEW VILLAGE SITE DURING WINTER.

TRUSS SPACER ARRANGEMENT SHALL BE:
TSBR TRUSS SPACER RESTRAINT: 5 PER SPACING.
TRUSS SPACER: 4 PER SPACING

FOUNDATION PLAN

FRAME PLAN

GABLE END WALL TRUSS LAYOUT

TRUSS SPACER DETAIL
NOTES

SPRAY-APPLIED POLYURETHANE INSULATION TO BE APPLIED FROM THE INTERIOR OF THE BUILDING TO THE BACK SIDE OF THE PLYWOOD IN THE ENTRY. ENTRY WILL NOT BE INSULATED. PLYWOOD MUST BE CONTINUOUS BACKING FOR FOAM APPLICATION FROM ROOF TO FLOOR.

SPRAY FOAM MUST BE STORED IN A HEATED SPACE PRIOR TO APPLICATION. BELOW FREEZING TEMPERATURES WILL DAMAGE THE MATERIAL.

EMPTY SPRAY FOAM BARRELS MUST NOT BE REUSED. CREW WILL DESTROY RED BARRELS SO THEY ARE NOT REUSED AS WATER CONTAINERS OR BURN BARRELS AFTER CONSTRUCTION

SPRAY APPLICATOR WILL APPLY 90MM POLY FLOORING TO ARCTIC ENTRY FLOOR. STIPPLE ORANGE PEEL MIST

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SPRAY APPLICATOR WILL APPLY 90MM POLY FLOORING TO ARCTIC ENTRY FLOOR. STIPPLE ORANGE PEEL MIST
NOTE
SITE CONDITIONS WILL VARY. PREFERRED ORIENTATION FOR SOLAR GAIN AND NATURAL LIGHTING IN LIVING SPACE IS SHOWN

1st FLOOR PLAN

QANARVIK
KENIRVIK
ELATURAQ
PORCH
LIVING
WATER STORAGE
OIL DRIP STOVE
FUEL TANK
BATTERIES
T/S HRV-C I-C
ANARVIK
BATHROOM 003
ELATURAQ
Storage 004
QANARVIK
BEDROOM 005
QANARVIK
BEDROOM 006
QANARVIK
BEDROOM 007
KENIRVIK
KITCHEN 008
LIVING 009
A: 45 sq ft
A: 95 sq ft
A: 160 sq ft
A: 118 sq ft
A: 120 sq ft
A: 138 sq ft
A: 248 sq ft
A: 84 sq ft

0' 4' 8' 12'

BLOCKING FOR FUEL STAND TO BE CONSTRUCTED BEFORE THE METAL SIDING IS ATTACHED

CONTINUOUS SPRAY-APPLIED INSULATION

N SITE CONDITIONS WILL VARY. PREFERRED ORIENTATION FOR SOLAR GAIN AND NATURAL LIGHTING IN LIVING SPACE IS SHOWN
NOTES
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IF CONSTRUCTED IN NEWTOK, THE DEMONSTRATION HOME FOUNDATION WILL BE CONSTRUCTED ON A DURABASE PAD. IF CONSTRUCTED IN MERTARVIK, A COMPACTED GRAVEL PAD WITH POSITIVE DRAINAGE WILL BE USED.

NOTES
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NOTES
SPRAY INSULATION: 7-1/2" ON ALL VERTICAL WALLS AND AROUND FULL WINDOW BOX HORIZONTALLY TO INSIDE SHEATHING.
### General Notes

1. **Wall and Roof Details**
   - **Eave Soffit Detail**
   - **Soffit Detail at Gable End**
   - **Lower Wall Detail**
   - **Upper Wall Detail**

2. **Propanel 2 Jamb Profile**
   - J-Channel Profile to Receive 3/8" Soffit
   - Metal Fascia
   - 2x6 Gable End Rafter (Part of Ladder Blocking Assembly)
   - Field Truss
   - Gable End Trusses 2x6 Ladder Blocking, Face-Nailed to Gable End Truss Prior to Tip-Up

3. **Metal Fascia**
   - Metal Siding
   - Corrugated Metal Roofing
   - Vented Soffit

4. **Eave Flashing**
   - Metal Fascia
   - 2x6 Fascia
   - Roof Truss Tail
   - Grace Ice & Water Shield
   - 1/2" CDX Plywood

5. **Rake Trim**
   - Propanel 2 Rake Trim
   - 2x10 Blocking Between Trusses
   - Soffit J-Channel Nailed to Underside of Rafter Tail

6. **Details**
   - 2" Wind Cleat
   - 6" Underfloor Insulations
   - Appro 1.5" below Underside of Floor
   - 2x10 Blocking
   - Metal Siding Extends Approx. 1.5" Beyond Underside of Floor
   - Appro 2" Wind Cleat

7. **Construction Documents**
   - Rev./Issue No.
   - DESIGNED BY:
   - DRAWN BY:

---

**NEWTOK, ALASKA**

**FIELD TRUSSES**

**NEWTOK DEMONSTRATION HOME**

**2nd September 2015**
PRO-PANEL II
20° RIDGE/HIP COVER
(NOT TO SCALE)

PRO-PANEL II RAKE

PRO-PANEL II EAVE (DIRECT FASTEN)

PRO-PANEL II EAVE (DIRECT FASTEN)

PRO-PANEL II OUTSIDE CORNER (WALLS)

PRO-PANEL II JAMB

1

EXTERIOR METAL TRIM

1 1/2"

4D GALV NAIL

2 1/2"

EVERY SOFFIT PANEL SECTION MUST BE FASTENED TO RESIST WIND BY PRE-DRILLING THROUGH BOTTOM EDGE OF METAL FASCIA AND SOFFIT PANEL, THEN NAILING THROUGH HOLE INTO BOTTOM EDGE OF 2x6 SUB-FASCIA, OR OTHER STABLE MEANS OF ATTACHMENT

INTERIOR WOOD TRIM INSTALLATION SEQUENCE:

1. PREFINISH: VARNISH ALL TRIM WITH SATIN WATER-BASED FINISH BEFORE INSTALLATION. MIN 2-COATS

2. STEP 1: INSTALL WALL-TO-CEILING INSIDE-CORNER TRIM

3. STEP 2: INSTALL WALL-TO-WALL INSIDE CORNER TRIM, BUTTED AGAINST WALL TO CEILING TRIM

4. STEP 3: INSTALL BASE TRIM AND DOOR CASINGS, BUTT BASE TRIM AGAINST WALL-TO-WALL INSIDE CORNER TRIM

5. STEP 4: INSTALL BATTEN STRIPS AND OUTSIDE CORNER TRIM

NOTE: DIMENSIONS FOR WOOD TRIM ARE APPROXIMATE, HOWEVER ROUND-OVERS MUST BE 1/8"

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NOTES
HORIZONTAL BLOCKING TO BE INSTALLED BEHIND CABINETS PRIOR TO SHEATHING IN AC PLYWOOD

KENIRVIK
A1-2.5 x 4.0
IE-02 02
IE-02 03

KITCHEN PLAN

1 INTERIOR ELEVATION-02 02

2 INTERIOR ELEVATION-02 03

3 KITCHEN DETAILS

" 4'-4" 9'-6"

NOTES
33 15/16"

RE 4'-4" 9'-6"

M1.0
IE-02 02
IE-02 03

OIL DRIP STOVE
KENIRVIK KITCHEN 008
A: 138 sq ft

HORIZONTAL BLOCKING TO BE INSTALLED BEHIND CABINETS PRIOR TO SHEATHING IN AC PLYWOOD

A4.3
### WINDOW SCHEDULE

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<thead>
<tr>
<th>LABEL</th>
<th>TYPE</th>
<th>WIDTH</th>
<th>HEIGHT</th>
<th>R.O.</th>
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### DOOR SCHEDULE

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<th>WIDTH</th>
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<th>SWING</th>
<th>HARDWARE</th>
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</tr>
</tbody>
</table>

**NOTES**

- UNDERCUT ALL BEDROOM DOORS 2" FOR RETURN AIR
POWER GENERATION/DISTRIBUTION SYSTEM

**SMALL LOADS SUB PANEL**

For the following loads:
- Lights
- Living area & bedroom receptacles
- HRV/AXIAL DUAL BOOSTER

**MAIN PANEL 120/240 VAC**

Main panel loads:
- Kitchen receptacles
- Stove
  (To be limited by 15A breaker)

**INVERTER MOUNTING PANEL/ENCLOSURE**

- ME-BMK Battery Monitoring Kit
- Magnum Inverter, HH51812
  (10kW, 12VDC)
- Inverter controller
  (PM-RC50)
- INTO BE LOCATED IN THE CENTRAL LIVING AREA

**OUTDOOR RECEPTACLE**

- Generator 120/240 VAC output

30-AMP
250 AMP
7500 WATT
NON-FUSE 6-CIRCUIT TRANSFER SWITCH KIT
(LOCATED IN ELATURAQ ENTRY)

**SERVICE METER (200 A)**

**NOTES**

This system is designed as a "Solar-Ready" system. The photovoltaic (PV) array

**COLD CLIMATE HOUSING RESEARCH CENTER**

100 Fairbanks Street
Fairbanks, AK 99701

5/4/16

CCHRC Intern

1142x639

SNC

1000 Fairbanks Street
P.O. Box 82489
Fairbanks, AK 99708-2489

(907) 457-3454

www.cchrc.org
1. VENMAR EXO HRV
2. UNDERCUT ALL BEDROOM DOORS 2"
3. ALL SUPPLY REGISTERS IN CEILING
4. MAXIMUM DUCT HANGER SPACING: 8'
5. HRV TO BE BALANCED TO SLIGHT (10CFM) POSITIVE PRESSURE
NEWTOK DEMONSTRATION HOME PROJECT
ISSUED 2nd September 2015

CONSTRUCTION DOCUMENTS

MECHANICAL SECTION

1 SEPARETT TOILET SYSTEM

0 1 2 3

AXIAL DUCT BOOSTER (30 WATTS FITS 6" DUCT)
6x4 GALV REDUCER
3" TO 4" REDUCER PVC
SOUND BATTING BELOW BOOSTER
INSULATED DUCT FROM HOOD TO HRV PORT
6" BACKDRAFT DAMPER
EXHAUST

3" PVC
6" DUCT
SUPPLY AND INTAKE DUCTS NOT SHOWN

3" PVC 90° ELBOW
3" PVC RUBBER COUPLING WITH HOSE CLAMPS
FERNCO PART# 1066-33 AS NEEDED
6" BACKDRAFT DAMPER

EXPLODED VIEW

3" PVC PIPE

BELL END OF 3" PVC
REDUCER WITH SEALS
SEPARETT PORT # 10186-01

75 mm OD COUPLING

SEPARETT VILLA 9200 TOILET

SEPARETT TOILET SYSTEM
M1.2

WATER SYSTEM

**GENERAL NOTES**

1. TOP OF TANK WILL VARY DEPENDING ON CEILING HEIGHT OF HOME.
2. TANK STAND WILL BE PRE-MANUFACTURED PRIOR TO SHIPMENT.
3. CAMPWATER SYSTEM AND TANK NSF #1.
4. LATERALLY RESTRAIN TANK USING A MINIMUM OF 2 EACH GALVANIZED STEEL STRAPS.

**MATERIAL LIST**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>QTY</th>
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<tbody>
<tr>
<td>①</td>
<td>1/8&quot; UNISTRUT 12 GA. PER FT</td>
<td>10</td>
</tr>
<tr>
<td>②</td>
<td>3/8&quot; -16 x 1&quot; BOLT (25/20K)</td>
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<tr>
<td>③</td>
<td>3/8&quot; BUT 9/16&quot; SPRING EA</td>
<td>14</td>
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<tr>
<td>④</td>
<td>3/8&quot; LOCK WASHER (250/400)</td>
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<tr>
<td>⑤</td>
<td>3/8&quot; WASHER (100/400)</td>
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<tr>
<td>⑥</td>
<td>2&quot; x 1/2&quot; HDG BRACKET</td>
<td>8</td>
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<tr>
<td>⑦</td>
<td>POST BRACKET 2&quot;HK</td>
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<tr>
<td>⑧</td>
<td>L BRACKET PKM</td>
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<td>SUCKER 48&quot; x 120&quot;</td>
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<td>3/4&quot; MIP TO 1/2&quot; SHARK BITE</td>
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<td>1/2&quot; SHARK BALL</td>
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<td>1/2&quot; SHARK TEE</td>
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<td>1/2&quot; SHARK 1/2&quot; FEMALE</td>
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<td>1/2&quot; HOSE BIB</td>
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<td>3/8&quot; + 1/2&quot; DURAC X BOLT (BOX 25)</td>
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<td>3/8&quot; R/HK NUT</td>
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<td>1/4&quot; x 2 1/2&quot; SS BOLT (BAD 20)</td>
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<td>1/4&quot; SS WING NUT</td>
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<tr>
<td>⑳</td>
<td>1/4&quot; SS WASHER (BAD 10)</td>
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<td>1/4&quot; STREET SPRING NUT</td>
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<td>1/4&quot; x 3&quot; BOLT</td>
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<td>1/4&quot; LOCK WASHER</td>
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<tr>
<td>㉛</td>
<td>3/8&quot; STREET 90 BRZ NPT</td>
<td>1</td>
</tr>
</tbody>
</table>

**DESIGNED BY:**

[Signature]

**DRAWN BY:**

[Signature]

**SNC**

1000 FAIRBANKS STREET
P.O. BOX 82489
FAIRBANKS, AK 99708-2489
(907) 457-3454
www.cchrc.org
**STORAGE:**

<table>
<thead>
<tr>
<th>UNITS</th>
<th>DESCRIPTION</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1100 LF</td>
<td>AS SPECIFIED BY MANUFACTURER (18lf per roof seam x 24 seams = 432lf) + (11lf vertical)</td>
<td></td>
</tr>
<tr>
<td>10 EA IB</td>
<td>19 ties per beam/row x 3 rows = 57ea round up to 65 IB</td>
<td></td>
</tr>
<tr>
<td>64 EA</td>
<td>3' PIECES (39lf ridge cap x 2 sides = 78lf) + (11lf corners x 2 sides =</td>
<td></td>
</tr>
<tr>
<td>192 LF</td>
<td>Outside closure Piece</td>
<td></td>
</tr>
<tr>
<td>¼&quot; HEX DRIVE  ¼&quot;-14 x ⅞&quot; STITCH SCREW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W/NEOPRENE SEALING WASHER (COLOR</td>
<td></td>
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</tr>
<tr>
<td>5 EA 10' LENGTHS (50lf) 39 lf = 4 pieces + 1 extra to include overlaps =50lf IB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PERFORATED METAL SOFFIT</td>
<td>160 LF 1'6&quot; EAVE OVERHANGS</td>
<td></td>
</tr>
<tr>
<td>70 EA PART# TSF2-24 FOR 2' OC FRAMING</td>
<td>4 TSF2'S PER SPACING, 16 FIELD TRUSSES ON CENTER = 64 Aa</td>
<td></td>
</tr>
<tr>
<td>1/4&quot; AIR HOSE IN 50' LENGTHS 4 EA</td>
<td></td>
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<tr>
<td>PNUEMATIC BOSTITCH  18 GAUGE CROWN STA</td>
<td>2 EA PART# SX1838K</td>
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<tr>
<td>1 1/4&quot; 16GA Galv Finish Gun Nails</td>
<td>2000 EA IB</td>
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<tr>
<td>2&quot; CERAMIC COATED BUGLE HEAD COARSE</td>
<td>2000 EA IB</td>
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<td>3&quot; Zinc Plated Drywall Screws</td>
<td>5 LBS IB</td>
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<td>5000 EA GRABBERS IB</td>
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<tr>
<td>2&quot; Zinc Plated Drywall Screws</td>
<td>10D Galv Common Gun Nails</td>
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<tr>
<td>1 1/4&quot; 16GA Galv Inside Corner</td>
<td>8D Rinkshank Galv Gun Nails</td>
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<tr>
<td>50 LBS IB</td>
<td>16D Galv Common Gun Nails</td>
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<td>1/2&quot; Backer Rod 120 LF IB</td>
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<tr>
<td>PROSOCO R-GUARD FASTFLASH  29 OZ</td>
<td>1/2&quot; CDX Plywood roof sheathing 55 SHEETS 39' x (17'-4&quot; run @ 3/12 pitch = 17' 10 3/8&quot; = ~18') =</td>
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<tr>
<td>3&quot; Ceramic Square Drive Decking Screw</td>
<td>2000 EA IB</td>
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<tr>
<td>25 LBS IB</td>
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<td>100 EA</td>
<td>2&quot; Interior commons for stair framing</td>
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<td>1 EA DURA SKRIM OR EQUIV.</td>
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<td></td>
<td>18 EA 16' LENGTHS GABLE WALLS (Gable wall 4 full sheets x 2 vertical rows = 8 sheets x 2</td>
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<tr>
<td>36 EA IB</td>
<td>silcon Clear Caulk 12 oz Tubes</td>
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<td>3&quot; x 9&quot; GLU LAM BEAM 4 EA 18' LENGTHS Aa</td>
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<td>1/2&quot; CDX Plywood</td>
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<tr>
<td>3/8&quot; CDX Plywood 38 SHEETS 32'X36' = 1152sqft /32 = 36 sheets + 2 extra IB</td>
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<td>1/2&quot; CDX Plywood</td>
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<td>2x6x16' 18 EA barge/rake rafters, eave fascia, and ladder blocking (Ladder blocking: 18' rafters @ 2'OOC blocking to build</td>
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<tr>
<td>14 EA</td>
<td>29OZ TUBE REF:</td>
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<td>600 EA #14 X 1-1/2 NEOPRENE WASHER GASKET SELF-</td>
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<td>DRILLING STITCHER SCREWS IB</td>
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<td>48 LF WHITE</td>
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<td>1 EA REF:</td>
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<td>7 EA PART# WB-126 FOR 8' CEILINGS Aa</td>
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<td>1 EA</td>
<td>SIMSON WALL BRACING</td>
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<td>1 EA</td>
<td>Drip Edge (Eave) Color A</td>
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<td>9 EA 10' LENGTHS  Bent at 3/12 pitch to match fascia to</td>
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### Materials List

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<td>15 A. RES GR RECEPT T.P.</td>
<td>30 EA</td>
<td></td>
</tr>
<tr>
<td>20 A. GFCI T.P.</td>
<td>11 EA</td>
<td></td>
</tr>
<tr>
<td>15 A. S.P. SWITCH</td>
<td>8 EA</td>
<td></td>
</tr>
<tr>
<td>15 A. 3-WAY SWITCH</td>
<td>4 EA</td>
<td></td>
</tr>
<tr>
<td>50 A. RANGE RECEPT.</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>TV JACK</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>S.G. RECEPT COVER THERMO</td>
<td>30 EA</td>
<td>JUMBO</td>
</tr>
<tr>
<td>SG SWITCH COVER</td>
<td>8 EA</td>
<td>JUMBO</td>
</tr>
<tr>
<td>2G SWITCH COVER</td>
<td>2 EA</td>
<td>JUMBO</td>
</tr>
<tr>
<td>RANGE RECEPT COVER</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>S.G. W.P. IN-USE COVER</td>
<td>2 EA</td>
<td></td>
</tr>
<tr>
<td>120 V. SMOKE DET. W/BATT</td>
<td>4 EA</td>
<td></td>
</tr>
<tr>
<td>20' SO CHORD</td>
<td>1 EA</td>
<td>FOR BATTERY BACKUP</td>
</tr>
<tr>
<td>MALE CHORD CAPS</td>
<td>1 EA</td>
<td>FOR BATTERY BACKUP</td>
</tr>
<tr>
<td>20 A. AFCI BRKR.</td>
<td>3 EA</td>
<td></td>
</tr>
<tr>
<td>20 A. S.P. BRKR.</td>
<td>7 EA</td>
<td></td>
</tr>
<tr>
<td>40 A. D.P. BRKR</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>LIGHT FIXTURES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OUTDOOR LIGHT</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>RECESSED CAN TRIM</td>
<td>5 EA</td>
<td></td>
</tr>
<tr>
<td>4' FLOOR. 4 L. FIXT.</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>BEDROOM FIXTURE</td>
<td>4 EA</td>
<td></td>
</tr>
<tr>
<td>VANITY LIGHT 4-BULB</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>4' FLOOR. 2 LAMP LB 232</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>MECHANICAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VENMAR 1.5 EKO HRV UNIT</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>VENMAR ALTITUDE MAIN CONTROL</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>VENMAR 20-40-60 BOOST SWITCH</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>6&quot; INSULATED FLEX - 25' BOX</td>
<td>2 EA</td>
<td></td>
</tr>
<tr>
<td>VINYL 6&quot; EXTERIOR HOOD</td>
<td>3 EA</td>
<td></td>
</tr>
<tr>
<td>6&quot; X 60&quot; 30 GA.</td>
<td>25 EA</td>
<td></td>
</tr>
<tr>
<td>6&quot; X 90 WARM AIR ELBOW BENT</td>
<td>18 EA</td>
<td></td>
</tr>
<tr>
<td>6&quot; T</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>6-6-6-Y</td>
<td>2 EA</td>
<td></td>
</tr>
<tr>
<td>6-6-6-STRAIT CONE Y</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>6&quot; ROUND CEILING DIFFUSER</td>
<td>6 EA</td>
<td></td>
</tr>
<tr>
<td>4&quot; X 10&quot; -6&quot; 90 REGISTER BOOT</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>6&quot; BACKDRAFT DAMPER</td>
<td>3 EA</td>
<td></td>
</tr>
<tr>
<td>6-4 REDUCER</td>
<td>1 EA</td>
<td></td>
</tr>
<tr>
<td>SHEETMETAL SCREWS</td>
<td>500 EA</td>
<td></td>
</tr>
<tr>
<td>SILVER FOIL TAPE</td>
<td>2 EA</td>
<td>2&quot; X 150YDS</td>
</tr>
</tbody>
</table>

---

**General Notes**

- Additional materials to be ordered and purchased.
- Intumescent paint H.25 for gable ends.
The Native Village of Kwinhagak

COLD CLIMATE HOUSING RESEARCH CENTER
CCHRC

Quinhagak Prototype

Rural Community Development Consultants
ThotPro Structural Engineering

Ventilation Solutions, LLC
Star Electric
Superior Mechanical

Quinhagak, Alaska

LIST OF DRAWINGS
A0.0 COVER SHEET
C1.0 SITE PLAN
A2.0 JOIST LAYOUT
A1.1 FIRST FLOOR PLAN
A1.2 DIMENSIONED PLAN
A0.0 ILLUSTRATIONS
S4.0 SECTION
S3.0 EXTERIOR FINISHING
S2.1 DETAILS
S2.2 DETAILS
S1.1 FINISHING PLAN
S1.2 PROOF PLAN
S1.3 OVERALL PLAN
S1.4 PRELIM
S1.5 TRASH PLAN
S1.6 WASTE CHUTE
E1.0 ELECTRICAL LIGHTING LAY.
E1.1 SENSOR PLAN
E1.2 SUPPORT PLAN
E1.3 PLUMBING
E1.4 MECHANICAL VENTILATION...
Quinhagak Prototype
Native Village of Quinhagak
Quinhagak, Alaska

CCHRC PAD

SITE PLAN

WATER DELIVERY POINT
SEWAGE TANK
FUEL TANK

FUTURE SEWER ROUTE
FUTURE PATH TO SEWER

NOTE: Slope between 2 Ground Elevations not shown

Drawing NOT TO SCALE

SCALE: 1/8" = 1'-0"

Elevation Variances from ground level on LOT MARKER

<table>
<thead>
<tr>
<th>Item</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>North ground level</td>
<td>0&quot;</td>
</tr>
<tr>
<td>Top of 16&quot; diameter pipe</td>
<td>1'9&quot;</td>
</tr>
<tr>
<td>Top of Elevated Pad</td>
<td>5'1&quot;</td>
</tr>
<tr>
<td>Road &amp; Gravel Pad</td>
<td>4'4&quot;</td>
</tr>
<tr>
<td>South ground level</td>
<td></td>
</tr>
</tbody>
</table>

C1.0

General Notes:

[Diagram details and notes are not transcribed due to the complexity and visual nature of the diagram.]
Quinhagak Prototype
Native Village of Quinhagak
Quinhagak, Alaska

1st FLOOR PLAN

Possible Furniture Layout
Quinhagak House
Kuinerramiut Ena

900 SF (conditioned)
1080 SF (total)
NORTH ELEVATION

EAST ELEVATION

WEST ELEVATION

SOUTH ELEVATION

Min. 10% Grade for positive drainage

Min. 10% Grade for positive drainage
1/2" 10GAUGE METAL ANGLE  
CORRUGATED METAL ROOFING RUN HORIZONTALLY  
1/2" AC PLYWOOD  
2x4 - 20 GAUGE STEEL STUD  
2x4 T&G PLYWOOD FLOORING  
11 7/8" BC JOIST  
BOTTOM TRACK  
HANGAR BRACKET  
LYMPHWOOD PLATE TO SPRAY FOAM AGAINST  
FOUNDATION PAD DETAIL SEE (S1.4)  
GRAVEL FILL MIN 10% SLOPE FOR DRAINAGE  

Roof Sheathing detail may change  
WINDOW DETAIL  

4" Outside bend  

4" Leg  

Worksheet  

Window Trim (Typical)  

2  

A4.2  

A4.1  

1  

SOFFIT DETAIL  

4  

SHEET  

9  

3  

A4.1  

A4.2  

DETAILED BY: CCHRC  
DRAWN BY: AC, CD, KS  
1000 FAIRBANKS STREET  
P.O. BOX 82489  
FAIRBANKS, AK 99708-2489  
(907) 457-3454  
www.cchrc.org  

OF  

Native Village of Kwinhagak  
Quinhagak, Alaska  

Quinhagak Prototype  
PROJECT ISSUED ##/##/####  

DESIGNED BY:  
DRAWN BY: CCHRC  

Roof Sheathing detail may change  

EXTERIOR MEMBRANE  
1/2" SOY SPRAY FOAM INSULATION  
PLATE  
BLOCKING  
TRUSS TOP CHORD  
GUTTER  
TRUSS BOTTOM CHORD  
2x4 T&G PLYWOOD FLOORING  
TOP TRACK  
PLASTIC SPACER or VINYL LATTICE ON 4 CENTERS  
SOY SPRAY FOAM INSULATION CONTINUOUS THROUGHOUT FLOOR/CEILING  
CORRUGATED METAL ROOFING RUN HORIZONTALLY  
1 1/2" 20 GAUGE METAL ANGLE  
CLEAR INTUMESCENT PAINT FINISH  
1/2" 10GAUGE METAL ANGLE  
METAL FASCIA  
PERFORATED METAL SOFFIT  
FASCIA BOARD  
DRIP EDGE  
GUTTER  
METAL FASCIA  

2x4 - 20 GAUGE STEEL STUD  

Soil Spray Foam Insulation Continuous  
Through Floor/Wall/Ceiling  

1 1/2" - 20 GAUGE METAL ANGLE  
CORRUGATED METAL ROOFING RUN HORIZONTALLY  
1/2" AC PLYWOOD  
CLEAR INTUMESCENT PAINT FINISH  
1 1/2" 20 GAUGE METAL ANGLE  
METAL FASCIA  

1/2" T&G PLYWOOD  

METAL FASCIA  

4" Outside bend  

3/4" Leg  

2  

Worksheet  

Window Trim (Typical)  

2  

A4.2  

A4.1  

1  

SOFFIT DETAIL  

4  

SHEET  

9  

3  

A4.1  

A4.2  

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PROJECT ISSUED ##/##/####  

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DRAWN BY: CCHRC  

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1/2" SOY SPRAY FOAM INSULATION  
PLATE  
BLOCKING  
TRUSS TOP CHORD  
GUTTER  
TRUSS BOTTOM CHORD  
2x4 T&G PLYWOOD FLOORING  
TOP TRACK  
PLASTIC SPACER or VINYL LATTICE ON 4 CENTERS  
SOY SPRAY FOAM INSULATION CONTINUOUS THROUGHOUT FLOOR/CEILING  
CORRUGATED METAL ROOFING RUN HORIZONTALLY  
1 1/2" 20 GAUGE METAL ANGLE  
CLEAR INTUMESCENT PAINT FINISH  
1/2" 10GAUGE METAL ANGLE  
METAL FASCIA  
PERFORATED METAL SOFFIT  
FASCIA BOARD  
DRIP EDGE  
GUTTER  
METAL FASCIA  

2x4 - 20 GAUGE STEEL STUD  

Soil Spray Foam Insulation Continuous  
Through Floor/Wall/Ceiling  

1 1/2" - 20 GAUGE METAL ANGLE  
CORRUGATED METAL ROOFING RUN HORIZONTALLY  
1/2" T&G PLYWOOD  
CLEAR INTUMESCENT PAINT FINISH  
1 1/2" 20 GAUGE METAL ANGLE  
METAL FASCIA  

1/2" T&G PLYWOOD  

**Exploded Axonometric of Wall Assembly**

1. **9" SPRAY FOAM**
2. **HANGAR BRACKET**
   - ITS 2.06/11.88 (typ)
3. **VBSALAM**
   - IPS 14" VERSALAM
   - 3/4" CDX PLY BETWEEN JOISTS @ BOTTOM WEB
4. **3/4" CDX PLYWOOD PLATE**
   - TO SPRAY FOAM AGAINST
5. **3" x 3" METAL ANGLE TO SUPPORT PLYWOOD PLATE**
6. **EPB44PHDG ELEVATED POST BRACKET**
7. **3" x 3" WASHING**
8. **BP 5/8-3 HDG**
9. **6" x 6" FOUNDATION GRADE PRESSURE TREATED TIMBER**

**Foundation Detail**

**Window Flashing Detail**

- Silicon adhered outside closure piece
- Metal cladding fastened to outer window flange
- 1/4" slit cut into the metal cladding
- Silicon adhesive to fill any gap at corner
- Bottom outer flange of window lapped over siding
- Spacer cut from non-conductive type plastic or vinyl lattice on 4" centers
- Start flush at top bar of track
- Outer studs move in 1 1/2" from layout on corners for ease of spray foam application
- 1/4" Plywood
- (2) 2" XPS blocking to hold joints off grade to break conduction prior to spray foam application

**Floor Framing Detail**

- 1 1/2" metal angle extend to top of 1st XPS blocking
- 6" Channel
- 2 2" spacers
### Quinhagak Prototype Window Schedule

<table>
<thead>
<tr>
<th>S.No.</th>
<th>TYPE</th>
<th>WIDTH</th>
<th>HEIGHT</th>
<th>Rough Opening</th>
<th>Material/Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PVC casement, Triple glazed with Argon gas and double flanged buck extension as per specifications</td>
<td>2'-6&quot;</td>
<td>3'-6&quot;</td>
<td>2'-7&quot;x3'-7&quot;</td>
<td>RIGHT</td>
</tr>
<tr>
<td>2</td>
<td>PVC casement, Triple glazed with Argon gas and double flanged buck extension as per specifications</td>
<td>2'-6&quot;</td>
<td>3'-6&quot;</td>
<td>2'-7&quot;x3'-7&quot;</td>
<td>LEFT</td>
</tr>
<tr>
<td>3</td>
<td>PVC casement, Triple glazed with Argon gas and double flanged buck extension as per specifications</td>
<td>2'-6&quot;</td>
<td>3'-6&quot;</td>
<td>2'-7&quot;x3'-7&quot;</td>
<td>RIGHT</td>
</tr>
<tr>
<td>4</td>
<td>PVC casement, Triple glazed with Argon gas and double flanged buck extension as per specifications</td>
<td>2'-6&quot;</td>
<td>3'-6&quot;</td>
<td>2'-7&quot;x3'-7&quot;</td>
<td>LEFT</td>
</tr>
<tr>
<td>5</td>
<td>PVC casement, Triple glazed with Argon gas and double flanged buck extension as per specifications</td>
<td>2'-6&quot;</td>
<td>3'-6&quot;</td>
<td>2'-7&quot;x3'-7&quot;</td>
<td>RIGHT</td>
</tr>
<tr>
<td>6</td>
<td>PVC casement, Triple glazed with Argon gas and double flanged buck extension as per specifications</td>
<td>2'-6&quot;</td>
<td>3'-6&quot;</td>
<td>2'-7&quot;x3'-7&quot;</td>
<td>LEFT</td>
</tr>
</tbody>
</table>

### Quinhagak Prototype Door Schedule

<table>
<thead>
<tr>
<th>S.No.</th>
<th>TYPE</th>
<th>WIDTH</th>
<th>HEIGHT</th>
<th>Rough Opening</th>
<th>Material/Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Steel leaf, Prehung Insulated exterior steel-NFRC rating R-6 minimum Prefinished wood interior door-solid core</td>
<td>3'</td>
<td>6'-8&quot;</td>
<td>RHIS</td>
<td>RIGHT</td>
</tr>
<tr>
<td>2</td>
<td>Steel leaf, Prehung Insulated exterior steel-NFRC rating R-6 minimum Prefinished wood interior door-solid core</td>
<td>3'</td>
<td>6'-8&quot;</td>
<td>LHIS</td>
<td>LEFT</td>
</tr>
<tr>
<td>3</td>
<td>Steel leaf, Prehung Insulated exterior steel-NFRC rating R-6 minimum Prefinished wood interior door-solid core</td>
<td>2'-8&quot;</td>
<td>6'-8&quot;</td>
<td>RHIS</td>
<td>RIGHT</td>
</tr>
<tr>
<td>4</td>
<td>Steel leaf, Prehung Insulated exterior steel-NFRC rating R-6 minimum Prefinished wood interior door-solid core</td>
<td>2'-8&quot;</td>
<td>6'-8&quot;</td>
<td>LHIS</td>
<td>LEFT</td>
</tr>
<tr>
<td>5</td>
<td>Steel leaf, Prehung Insulated exterior steel-NFRC rating R-6 minimum Prefinished wood interior door-solid core</td>
<td>2'-8&quot;</td>
<td>6'-8&quot;</td>
<td>RHIS</td>
<td>RIGHT</td>
</tr>
<tr>
<td>6</td>
<td>Steel leaf, Prehung Insulated exterior steel-NFRC rating R-6 minimum Prefinished wood interior door-solid core</td>
<td>2'-8&quot;</td>
<td>6'-8&quot;</td>
<td>LHIS</td>
<td>LEFT</td>
</tr>
</tbody>
</table>
NOTES:
- DRAWING IS REPRESENTATIONAL
- EACH PAD SHOULD BE SITE-ROTATED TO BEST CENTER 6 x 6 ACROSS PAD

SCALE: 1:26.66

FOUNDATION PADS (only)
ADJUSTABLE FOUNDATION AXON

SKIRTING TO BE FIELD-CUT

ITS 2.06/11.88
11 7/8 BCI TOP HANGARS (typ)

11 7/8 BCI

(2) 14" VERSALAMS

NL26 ANGLE
(8) 1/4" x 1 1/2" SDS Screws

EPB44PHDG ELEVATED
POST BRACKET w/
5/8" GALVANIZED HEAVY NUT

3" x 3" x 1/4" WASHER
BP 5/8 - 3 HDG

6" x 6" x 3 FOUNDATION GRADE
PRESSURE TREATED TIMBER

6" TIMBERLOC

FIELD TRIM FOR
CONTINUOUS SKIRTING

1/4" x 3" SDS
AND GLUED

2x (3) 4" x 12" FOUNDATION GRADE
PRESSURE TREATED TIMBER

2'-10"
In T8 fixtures with LED strips, ballast to be disconnected and bypassed (but not removed)
Quinhagak House
Kuilnerramit Ena
500 SF (conditioned)
1080 SF (total)

- Install the block on the inside of the outer siding before foaming from the rear on the rear wall of the attic.
- Install the pins one inch apart parallel to the grain in the top chord. Run the wire across the attic.
- Install at the top of the stove pipe. Run across the attic.
- Installed on the oil tank outlet line. Run the wire up the inside of the wall and across the attic space.
- Install the block on the inside of the outer siding before foaming. Run the wire up the wall and across the attic.

**SCALE: 1:0.46**

**Monitoring Plan**
MECHANICAL/VENTILATION

<table>
<thead>
<tr>
<th>UNIT DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNITS</th>
<th>PRICE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venmar 1.5 EKO with Altitude main control and 2 boost buttons</td>
<td>1 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4&quot; screened exhaust hood [washer/drier]</td>
<td>1 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&quot; Screened Exhaust Hood</td>
<td>1 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&quot; screened intake hood</td>
<td>2 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7&quot; Insulated Flex duct box</td>
<td>2 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&quot; Insulated Flex-25' box</td>
<td>1 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4&quot; adjustable elbows</td>
<td>6 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&quot; adj 90</td>
<td>25 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&quot;x60&quot; 30 Ga.</td>
<td>20 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4&quot; x 60 30G.</td>
<td>10 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-6-6 Y</td>
<td>4 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&quot; round Ceiling Diffuser</td>
<td>9 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silver Foil Tape</td>
<td>2 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-6-6 Tee</td>
<td>2 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plumbing Strap Plastec- 100'</td>
<td>1 ROLL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perforated Angle (1-1/2x1-1/2x36&quot;), lag bolts and washers, s-hooks</td>
<td>1 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humidistat Control for Venmar EKO</td>
<td>1 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60/40/20 Booster Switch for HRV (Venmar EKO)</td>
<td>1 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manometer for HRV Pressure Differential</td>
<td>1 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LifeBreath Intake/Exhaust Hood Kit with Starter Collars</td>
<td>2 ea</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Make-up Air

Behind the Fridge

Make-up Air Intake
HRV Fresh Air

Intake

HRV Stale Air

Exhaust

Bath Fan

Drier Vent

Recirc only

Bathroom/ Anarvik

063

A: 61 sq ft

P: 30'-5"

Porch/ Elaturaq

064

A: 173 sq ft

P: 61'-8 3/4"

Pantry

065

A: 23 sq ft

P: 23'-2 1/2"

Kitchen/ Kenirvik

066

A: 467 sq ft

P: 111'-5"

Living

068

A: 323 sq ft

P: 82'-4 1/2"

Bedroom/ Qavarnik

079

A: 84 sq ft

P: 36'-5 1/4"

Bedroom/ Qavarnik

080

A: 91 sq ft

P: 38'-9 3/4"

Master Bedroom/ Qavarnik

081

A: 109 sq ft

P: 43'-3 1/4"

Mech

087

A: 34 sq ft

P: 23'-6 3/4"
PLUMBING MATERIALS LIST QUINHAGAK HOUSE

<table>
<thead>
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General Notes:
- TOILET MUST BE RAISED 5/8" ABOVE THE FF. 5/8" MINIMUM HIGHER THAN GRINDER PUMP
- 3-1/2" CHASE WAINSCOT - HEIGHT FLUSH WITH VANITY COUNTERTOP

PLUMBING PLAN
SCALE: 1/4" = 1'-0"
PROJECT:

SPENARD BUILDERS SUPPLY

20x20 "HAWK"

MODEL HOME KIT

DESIGN DOCUMENTS
NOT FOR CONSTRUCTION

EDITED CCHRC (AC) 3/27/14

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SOUTH WEST AXON

NORTH EAST AXON

EXTERIOR WALL ASSEMBLY
- METAL PANEL (RUN HORIZ.)
- 1X FURRING STRIP (ATTACHED WITH FASTENERS)
- 6" FOAM BOARD INSULATION (2 LAYERS EACH 3" THICK)
- EXTERIOR MEMBRANE [A]
- STRUCTURAL SHEATHING
- WALL FRAMING (WITH R-11 OR R-13 BATTING)
- INTERIOR SHEATHING

W1

INTERIOR PARTITION
- SHEATHING (1/2" AC or GWB)
- 2x4 WALL FRAMING
- SHEATHING (1/2" AC or GWB)
- R13 BATT

P1

DOOR SCHEDULE

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<td>INSULATED METAL DOOR</td>
<td>INSULATED METAL</td>
<td>COMMERCIAL GRADE BALL-HINGE</td>
<td>LHIS</td>
<td>32&quot;</td>
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WINDOW SCHEDULE

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<td>RHOS</td>
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ASSEMBLY TYPES
FLOOR PLAN

NOTES:
- DIMENSIONS TO FACE OF FRAMING (F.O.F.)
- STAIR PACKAGE T.B.D. BY SITE CONDITIONS
- *IDEAL SITE ORIENTATION

DESIGN DOCUMENTS
NOT FOR CONSTRUCTION

REV./ISSUE
No.
DATE
OF
SPENARDS BUILDERS SUPPLY
20x20 HAWK

DESIGNED BY:
DRAWN BY:
CD, TD, JG

A1.2
4

1' 2' 4'

WOOD STOVE
FRIDGE
TOYO (OR EQUIV)
SEE A3.4 FOR KITCHEN LAYOUT DETAILS

A3.0
A2.1
A2.0

P1

N*

W1

NORTH ELEVATION

CENTER LINE DIMS.
ROUGH OPENING DIMS.
ENTER LINE DIMS.
NOTES:
STAIR AND STRUCTURAL PACKAGE T.B.D. BY
SITE CONDITIONS
*IDEAL SITE ORIENTATION

FLOOR ABOVE

NOT FOR CONSTRUCTION
EAST ELEVATION

- RANGE HOOD EXHAUST
- 14'-8" ROOF RIDGE
- +8'-0" TOP OF WALL
- +6'-0" FLOOR
- CLOSED COMBUSTION CONCENTRIC VIEW (SPECIFIC TO STOVE)
- METAL CORNER TRIM [TYP] [W/ FOAM CLOSURE STRIP]
- FOUNDATION DESIGN & PACKAGE VARIIES BY SITE (REF SBS DESIGN)

WEST ELEVATION

- RANGE HOOD EXHAUST
- WOODSTOVE CHIMNEY HEIGHT TO BE COMPLAINT WITH CODE
- CHIMNEY JACK FLASHING
- METAL CORNER TRIM [TYP] [W/ FOAM CLOSURE STRIP]
- FOUNDATION DESIGN & PACKAGE VARIIES BY SITE (REF SBS DESIGN)

NOTES:

- EDITED CCHRC (AC) 3/27/14
- 8'-0" 9'-0" 8'-0"
- 6'-8" 15'-8"
- 1'-0" 2'-8"
- 3'-4" 2'-0" +14'-8" ROOF RIDGE +8'-0" TOP OF WALL +0'-0" FLOOR

- METAL SIDING TYP.
- RANGE HOOD
- EXHAUST
- CHIMNEY JACK FLASHING
- METAL CORNER TRIM (TYP) [W/ FOAM CLOSURE STRIP]
- FOUNDATION DESIGN & PACKAGE VARIES BY SITE (REF SBS DESIGN)

DESIGN DOCUMENTS
NOT FOR CONSTRUCTION
NOT FOR CONSTRUCTION

N S ELEVATIONS

1 NORTH ELEVATION

2 SOUTH ELEVATION

EXHAUST FAN WITH HUMIDISTAT CONTROL

WOODSTOVE CHIMNEY: HEIGHT TO BE COMPLIANT WITH CODE

+14'-8" ROOF RIDGE

+4'-0" TOP OF WALL

+4'-0" FLOOR

TIN LENGTH 13'-4"

RIDGE CAP

PREFERRED: SEALED COMBUSTION KIT (SPECIFIC TO STOVE)

IF NO KIT IS AVAILABLE, INSTALL 4" MAKEUP AIR DUCT THROUGH FLOOR PLENUM BELOW HEAT SHIELD

METAL CORNER TRIM (TYP) [W/ FOAM CLOSURE STRIP]

METAL SIDING TYP

METAL CORNER TRIM (TYP) [W/ FOAM CLOSURE STRIP]

FOUNDATION DESIGN & PACKAGE VARIES BY SITE (REF SBS DESIGN)

FOUNDATION DESIGN & PACKAGE VARIES BY SITE (REF SBS DESIGN)

EXHAUST FAN W/ HUMIDISTAT CONTROL

+14'-8" ROOF RIDGE

+4'-0" TOP OF WALL

+4'-0" FLOOR

TIN LENGTH 13'-4"

RIDGE CAP

PREFERRED: SEALED COMBUSTION KIT (SPECIFIC TO STOVE)

IF NO KIT IS AVAILABLE, INSTALL 4" MAKEUP AIR DUCT THROUGH FLOOR PLENUM BELOW HEAT SHIELD

METAL CORNER TRIM (TYP) [W/ FOAM CLOSURE STRIP]

METAL SIDING TYP

METAL CORNER TRIM (TYP) [W/ FOAM CLOSURE STRIP]

FOUNDATION DESIGN & PACKAGE VARIES BY SITE (REF SBS DESIGN)

FOUNDATION DESIGN & PACKAGE VARIES BY SITE (REF SBS DESIGN)
DESIGN DOCUMENTS
NOT FOR
CONSTRUCTION

EAVE WALL SECTION

0'-0" FLOOR
8'-0" TOP OF WALL

GABLE END WALL SECTION

0'-0" FLOOR
8'-0" TOP OF WALL

14'-8" ROOF RIDGE

WALL SECTIONS
A3.1

TOTAL
1

NOTES:
EDITED CCHRC (AC)
3/27/14

1
2
3
4

0'-0" FLOOR
8'-0" TOP OF WALL
14'-8" ROOF RIDGE

R1-60 BATT INSULATION

C1

F1

W1
EAVE RAFTER

1. Exterior Siding
2. 6" Foam Board Insulation (2 Layers Each 3" Thick)
3. 1x Furring Attached to Stud with 8" Screws
4. 0'-0" Floor
5. 15 5/8" Underside of BCI
6. 3" Rigid Foam Board

EAVE WALL FOUNDATION

1. Exterior Siding
2. 6" Foam Board Insulation (2 Layers Each 3" Thick)
3. 1x Furring Attached to Stud with 8" Screws
4. 0'-0" Floor
5. 15 5/8" Underside of BCI
6. 3" Rigid Foam Board
7. 5 1/8" x 24" GLB

GABLE END RAFTER

1. Exterior Siding
2. 6" Rigid Foam Board Insulation (2x 3" PCS.)
3. 1x Furring Attached to Stud with 8" Screws
4. 0'-0" Floor
5. 11-7/8" BCI 6000 SERIES
6. 3" Rigid Foam Board
7. 5 1/8" x 24" GLB

GABLE END FOUNDATION

1. Exterior Siding
2. 6" Rigid Foam Board Insulation (2x 3" PCS.)
3. 1x Furring Attached to Stud with 8" Screws
4. 0'-0" Floor
5. 11-7/8" BCI 6000 SERIES
6. 3" Rigid Foam Board
7. 5 1/8" x 24" GLB

NOTES:

- Edited CCHRC (AC) 3/27/14
- 3" Rigid Foam Board
- 6" Rigid Foam Board Insulation (2x 3" PCS.)
- 5-1/8" x 24" GLB
- 3" Rigid Foam Board
- 11-7/8" BCI 6000 SERIES
- **Window Detailing**
  - **R.O. Sill**: 2'-8"
  - **Receiving Channel for Jamb Extension**: 3/4" Foam Backer Rod
  - **Airgap Filled with Expanding Foam**: 3/4" Foam Board Insulation
  - **Jamb Extension**: 3/4" (Top at 2 Degree Slope)
  - **Window Nail Flange (Caulked)**
  - **Metal Siding**: Flexible Adhesive Flashing (Optional)

- **Roof Jack Section**
  - **R.O. Header**: 6'-0"
  - **Wall Framing with Batt Insulation (2 Layers Each 3" Thick)**
  - **Structural Sheathing**: J-Metal Channel
  - **Exterior Membrane**: Wall Framing with Batt Insulation
  - **Exterior Membrane**: Structural Sheathing
  - **Exterior Membrane**: Exterior Membrane
  - **Exterior Membrane**: J-Metal Channel
  - **Exterior Membrane**: 3/4" Receiving Channel for Jamb Extension
  - **Exterior Membrane**: Foam Backer Rod
  - **Exterior Membrane**: Airgap Filled with Expanding Foam
  - **Metal Siding**: Foam Backer Rod
  - **Metal Siding**: J-Metal Channel
  - **Metal Siding**: 3/4" Receiving Channel for Jamb Extension
  - **Metal Siding**: Foam Backer Rod
  - **Metal Siding**: Airgap Filled with Expanding Foam
  - **Metal Siding**: Metal Siding
  - **Metal Siding**: Metal Siding
  - **Metal Siding**: Metal Siding

- **Design Documents**
  - *Not for Construction*

- **Notes**
  - **Edited CCHRC (AC)**: 3/27/14

- **Details**
  - **Design Drawings**: CD, TD, JG
  - **DESIGNED BY**: CD, TD, JG
  - **DRAWN BY**: CD, TD, JG

- **Project**: 20x20 Hawk Project

- **Revision**
  - **Issue**: 20x20 Hawk Project
  - **Date**: 3/26/2014
KITCHEN LAYOUT

KITCHEN PERSPECTIVE
GENERAL NOTES:

01. Exhaust and intake hoods should be at least 18' above ground or above snow drift height.

02. Put attic access (at least 30" x 22") in entry for access.

03. All ducting in attic shall be insulated with minimum R-4 insulation.

04. Kitchen makeup air: Drop down in wall and bring in behind refrigerator. Reverse P-trap for cold air trap.

05. Flex Duct Installation
   a. All flex duct shall be installed fully extended: DO NOT install in the compressed state or use excess lengths (using more than necessary to get from A to B, and leaving the excess curling around).
   b. Avoid bedding ducts across sharp corners or incidental contact with metal fixtures, pipes or conduits. Radius at centerline shall be no less than one duct diameter.
   c. Requires CONTINUOUS support.

06. Install vertically ducted makeup air in kitchen.

07. All exhaust hoods shall have a back draft damper (unless specified otherwise).

IMC 2006 CODE NOTES:

501.2.1: HRV EXHAUST - MIN 3'-0" SEPARATION FROM OPERABLE WINDOWS, MIN 10'-0" FROM MECHANICAL INTAKES

504.4: DRYER AND RANGE HOOD EXHAUST - MIN 18" IF FROM MECH INTAKES

FRESH AIR KIT (COMPATIBLE WITH STOVE) INSTALL AS PER MANUFACTURER DIRECTIONS

MECHANICAL PLAN

THIS MAKE-UP AIR DUCTING IS REQUIRED IF THE WOODSTOVE IS NOT EQUIPPED WITH A SEALED COMBUSTION DUCTING KIT. FAILURE TO PROPERLY INSTALL CAN RESULT IN DANGEROUS BACKGRAFTING OF WOODSTOVE.

MECHANICAL KEY

- CONCENTRIC VENT
- EXHAUST VENT
- INTAKE VENT
- DUCT IN-CEILING
- FAN
- VENT
- 6" OVAL DUCT
- MAKE UP

LIVING

BATH/UTILITY

KITCHEN

WOOD STOVE

ARCTIC ENTRY

BATH/UTILITY

KITCHEN

WOOD STOVE

EXHAUST VENT

INTAKE VENT

DUCT IN-CEILING

FAN

VENT

6" OVAL DUCT

MAKE UP
The REMOTE Wall System described in this manual is an outside insulation technique using rigid foam board. It is the culmination of many years and creative force of home builders, researchers and home-owners throughout the North. The basic concept was derived from a Canadian engineer, Max Baker, who first pioneered outside insulation in the 1950s. Over the past 10 years we have researched and collaborated with partners on various projects to study the REMOTE wall system, and and refine the construction techniques that work best in the Circumpolar North’s varied, and often harsh, climates.

This manual is a detailed guide for the REMOTE Wall system. However, it is just the beginning of what we hope will be a vigorous and productive conversation about one of the most important subjects affecting the quality of life in our world today—safe, energy-efficient shelter.

We encourage you to use this manual as a guide, and to bring to it your own experiences, skills and knowledge. Above all, we hope you will join us in the conversation about how to improve on it.

_Jack Hébert_, President/CEO, CCHRC and owner of Hébert Homes/Taiga Woodcraft
PLEASE NOTE:

As with all complicated projects, there are many elements to consider and many available products. We strongly urge you to research products, codes and climatic effects prior to building.

This publication provides only general guidelines for the REMOTE Wall System.

And as with any building project, check your local, county, state and national building and safety codes before beginning construction. If you are building in an area with local codes, they may have amendments that will take precedence over national code. In Alaska, the Alaska Housing Finance Corporation Building Energy Efficiency Standard (BEES) has been amended and must be complied with in order to qualify for the state-sponsored Home Energy Rating Program and its associated incentives. This includes higher minimum insulation requirements and changes in ventilation standards over national code. These amendments can be found at: http://www.ahfc.state.ak.us/iceimages/reference/bees_amendments.pdf.

This document is a work in progress and we will publish updates as needed. If you wish to be notified of new editions, please forward your email address or other contact information to: info@cchrc.org. We will continue to publish this manual on our website, where it can be downloaded for free.

Thank you to our reviewers

Thorsten Chlupp
Terry Duszynski
Marquam George
Chuck Renfro
Steve Wisdom

Remote, A Manual was produced by the Cold Climate Housing Research Center, July 2009.
Revised July 2013.
Written by Ilya Benesh, Building Educator
Photos by Ty Keltner, Video Production Manager (unless otherwise noted)
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REMOTE Wall System Overview

Conventional wall construction methods may be less expensive initially, but in the long term can result in higher heating costs and lead to moisture management problems. Cold climate construction techniques must address four issues successfully: moisture control, air tightness, air quality, and adequate insulation.

The Moisture issue.

Control of moisture is one of the biggest challenges of home building in cold climates. This moisture can originate from the interior due to cooking, bathing, plants and many other sources. Moisture can also originate from the exterior from precipitation that leaks past the siding or from soil moisture that is drawn into below-grade assemblies.

From the Inside

Setting aside obvious faults such as plumbing leaks, the primary sources of moisture inside the home occur naturally from occupants in the form of water vapor. This water vapor must be prevented from escaping into the building shell. There are two primary mechanisms by which moisture from interior water vapor can migrate into the shell: air transport (leakage) and diffusion. It is generally accepted that of the two mechanisms, air leakage is of primary concern. Two conditions must exist for air leakage to take place: you must have both a driving force and a leakage pathway. The driving force is virtually always present, as it is provided by air pressure differences between the interior and exterior due to stack effect, wind, and mechanical systems such as exhaust fans. As a result, controlling air leakage must be primarily accomplished through construction techniques to minimize holes in the envelope. Conventional vapor retarder and air barrier systems can fail in cold climates due to imperfect sealing. Any penetrations - such as those caused by electrical outlets, fasteners, or vents - create vulnerabilities if they are not detailed meticulously.

From the Outside

Alaska’s coastal climates encounter a phenomenal amount of precipitation, often accompanied by winds that can force moisture into the building shell. When a weather resistive barrier is placed immediately behind the siding without an air gap to promote drying, it’s effectiveness and lifespan may be reduced. Even if the framing is protected from liquid water, moisture absorbed in siding can diffuse inward from solar heating. This can create vapor pressure differentials across the building envelope even greater than those produced by dry, arctic winter conditions where the vapor drive occurs predominantly from the interior.

If the wetting of wood framing occurs frequently and over a long enough time period, mold and rot can develop inside the building envelope. Mold growth can cause poor indoor air quality, and rot can lead to structural problems.

The Insulation issue.

Exterior walls comprise the largest surface area of the building shell in a typical home. As a consequence, an under-performing wall system is often responsible for a majority of space heating costs. High fuel prices have shown that in cold climates standard 2x6 wood construction methods can be costly to sustain. The walls lack sufficient insulation and suffer heat loss through thermal bridging in the wood framing components, further reducing the insulating value. Depending on layout and construction methods, a standard wood-framed wall contains between 11% and 20% wood. Wood has an R-value of about 1.25 per inch, reducing the overall R-value in a wall despite the addition of fiberglass batting. In addition, the fiberglass insulation must be installed with extreme care. Voids, compression, and air leakage (even if minor in appearance) can have a dramatic effect on insulation performance. If insulation becomes wet due to moisture infiltration, or if air leakage is factored in, then the R-value of the wall assembly can drop dramatically. The bottom line: a better approach to wall systems is required to overcome the many challenges in cold climate construction.

One Solution.

The REMOTE Wall System (Residential Exterior Membrane Outside insulation TEchnique) provides a superior alternative that integrates standard frame construction with high insulation values and moisture control (Figure 1). This system has been tested extensively in Interior Alaska by the Cold Climate Housing Research Center (CCHRC) in Fairbanks, and Maritime Southeast Alaska as a partnership between CCHRC and the University of Alaska Southeast Construction Technology Program in Juneau.
How REMOTE works.

Instead of relying on interior vapor retarders placed behind drywall, the REMOTE Wall System locates an air and/or vapor retarder ("exterior membrane") on the exterior of the house, over the sheathing. The bulk of the wall insulation is provided by rigid foam boards, which are attached to the outside of the structure over the exterior membrane. The goal of this approach is to move the dew point out from within the stud bays and to the exterior side of the sheathing, thus preventing framing members from cooling to the point that condensation can occur.

Advantages.

The REMOTE system has several advantages. When properly constructed, it creates a super-insulated wall that effectively eliminates thermal bridging and air movement. The wall cavities can dry to the inside if any wetting events occur or if the framing lumber is not dry before use. Exterior walls, which are a traditional freezing danger zone, are now available to run plumbing and mechanical systems with much less risk. Less expensive 2x4 construction is a viable option because the stud bays no longer need to hold large amounts of insulation. The system protects structural members and is durable.
Overview

The REMOTE system employs standard framing methods with a few notable exceptions.

**Framing and Furring layout.**

Because the exterior furring must support siding, vertical furring should line up directly on the studs. Consequently, if the siding allows for a maximum of 16 inch on-center attachments, the structure should be framed accordingly. The location of windows and doors near corners will be affected by the additional thickness of the exterior insulation. One popular option is to use 2x6 framing with studs placed two feet on center. This approach yields a deeper stud cavity to run mechanical systems, particularly heat recovery ventilator (HRV) ducts, and meets code for spacing in two-story structures where the walls are supporting a floor, roof, and ceiling. Two feet on center is also the maximum stud spacing for 0.5 inch sheetrock as specified by 2006 International Residential Code R602.3(5). It is considered good practice to line up (“stack”) all studs between floors, along with the joists and trusses. This approach can save on lumber, lines up the load paths in the framing, and keeps the stud and joist bays in line with each other between the floors to more efficiently run ducting.

**Exterior foam board and Truss Intersections.**

Truss design and the desired amount of attic insulation should be determined before framing begins. Wall insulation and attic insulation must meet in the same place and in the same plane in order to maintain a continuous thermal barrier. This can be accomplished by either extending the attic insulation out over the top of the wall to line up flush with the wall insulation (Figure 2), or extending the wall insulation up into the truss bays high enough to be level with the top of the attic insulation (Figure 3). Plan your interior and exterior insulation strategy around your truss choice (Figures 2 and 3). A continuous thermal boundary is critical to have continuous coverage where the outside walls transition to the truss bays.

Truss choice and insulation strategy also depend on your blocking options. Building codes typically require blocking, placed between the trusses and securely nailed directly over the double top plate in order to meet shear requirements. This means that any insulation in the attic is forced to end at the blocking, leaving the area directly outside the blocking exposed. There are several options here that can be presented to an inspector:

- **Solid blocking** can be installed between the trusses and fastened directly into the double top plate, as is traditional. This will require the exterior wall foam boards to be cut and fitted between the truss tails to the height of the ceiling insulation.

- If the code allows, diagonal bracing can be substituted for solid blocking directly over the walls. A baffle can then be added to the exterior side of the blocking in plane with the outside of the wall foam board. This way attic insulation can be blown between the braces from inside the attic, all the way out flush to the exterior of the wall (Figure 2).

- A raised heel truss can accommodate large amounts of insulation depending on the height of the heel. If the bottom chord of the truss ends at the exterior of the wall, then the wall sheathing can be continued up the heel of the truss until it hits the top chord which can also strengthen the blocking in this area. See Figure 3 and Images 1 and 2.

- To adjust for the added thickness of the wall insulation, truss tails should be ordered longer than usual, i.e., a wall with a two foot truss tail and six inches of exterior foam board will have a visible overhang of slightly less than 18 inches. If a two foot finished overhang is desired, then the tail should be ordered at least two feet, six inches.
Figure 2. BRACING WITH ROOF INSULATION OVER WALL INSULATION

Figure 3. BRACING WITH ROOF INSULATION ABUTTING TOP CHORD, DEEPER ENERGY HEEL TRUSS
Image 1. *Exterior View:* 18-inch-deep energy heel truss allows for R-60 roof insulation and easy continuation of wall foam to the top of the attic insulation.

Image 2. *Interior View:* 18-inch-deep energy heel truss allows for R-60 roof insulation and easy continuation of wall foam to the top of the attic insulation.
Wall Framing
Summary and Installation Tips

- Standard ICC and other building codes apply to this wall technique. Check before you build!
- Either 2x4 or 2x6 framing works with this system.
- Layout for windows and doors may be affected by the extra thickness of the exterior insulation, so plan ahead.
- Exterior walls are available to safely run most mechanical and plumbing systems.

Roof Trusses
Summary and Installation Tips

- Determine what approach will be used to provide truss blocking before ordering trusses. This may require reviewing building codes or consulting an engineer.
- Select your truss option early in the project so that the purchase of other materials can be planned around the truss system.
- Ensuring continuous coverage of insulation between and around trusses is critical to energy savings.
- Factor in the amount of visible overhang that will be lost by the thickness of the exterior foam and order longer truss tails if desired.
Decks and other exterior structures.

Attachment points for decks and other structures that are fastened to exterior walls usually consist of blocks built up to the finished thickness of the foam board rather than continuous ledger boards (Figure 4). This method minimizes the solid wood surface area that can conduct cold to the inside. As in all cases requiring structural loads, an engineer may be required to size the blocking and specify what method and type of attachment must be used. Local code requirements may conflict with this approach and need to be considered early in the design process. Any structural blocking between the studs can be easily installed before walls are sheathed and raised. All metal fasteners that penetrate through the entire wall, from outside to inside, and that are exposed to air in the inside conditioned space, need to be covered with spray foam or a similar material to avoid condensation or icing problems inside the walls (Images 3 through 7).

Figure 4. MOUNTING DECKS AND OTHER EXTERIOR STRUCTURES
Framing

Image 3. Deck blocking over 6-mil polyethylene

Image 4. Insulating deck fastener penetrations on interior to prevent condensation

Image 5. Installed foam between cantilevered joists
Framing

Image 6. Deck blocking and ledger board

Image 7. Deck framing
Decks
Summary and Installation Tips

- For the best thermal performance, deck attachment points should be blocks, not continuous ledger boards.
- Consult with an engineer for block and load-bearing calculations.
- Structural blocking between the studs, as needed to support decks and roofs, can often be more easily installed before the walls are sheathed and raised.
- Any fasteners that extend from the exterior through the wall, and that are exposed inside the stud bays, should be covered with foam insulation to avoid condensation or icing problems inside the wall (Image 33).
Overview

A REMOTE wall is much thicker than a conventional wall due to the multiple layers of exterior foam board. This results in very deep window and door wells. Two ways to deal with these deeper wells depend upon the given climate and desired outcome: mount the window flush to the exterior foam board, or inset the window and mount it on the sheathing behind the foam board. Both methods assume flange-mounted windows will be used as they are more prevalent and tend to be easier to install and flash. Windows without flanges are certainly viable, but detailing methods will be different. In most installations, the inclusion of a foam backer rod, caulked in place as necessary, yields the best results when initially sealing between the framing and the jamb. Spray foam can be used to fill the remaining gap. The backer rod provides the compressive element and the memory to provide a better long term seal. Spray foam alone might not seal adequately, especially if the exterior membrane has been wrapped and stapled into the window well.

Exterior-mounted windows.

In a drier climate, such as Fairbanks, Alaska, the door and window bucks can be sized to extend the entire depth of the wall, thus breaking the drainage plane of the sheathing and the exterior membrane (Figure 5). Proper sizing requires measuring the thickness of the framed wall, sheathing, foam board, and furring. When sizing the jamb extensions that comprise the opening, take the foam board measurement from the actual material to be used—foam board sheets can vary slightly in thickness in different manufacturing runs. One approach is to frame the opening traditionally, but oversize it by 1.5 inches on all sides that will have a jamb extension (Image 8), four sides on a window and three sides on a doorway. After the wall is sheathed and the openings are cut out, the extended window and door bucks can be installed and nailed in place. If the wall is thicker than a 2x12, such as a 2x6 framed wall with six inches of exterior foam board, then the 2x12 extensions are installed to be flush to the finished exterior face to provide secure window/door attachment and sealing. The window bucks can be brought to full depth on the interior side framing with furring strips nailed to the inner edges of the buck. The 1x4 furring is fastened through the foam board in a frame around the buck—not on—to provide for the attachment of siding and trim. There are more creative framing variations that can incorporate the jamb extensions into the trimmers to save on the extra layer of framing lumber. The critical issue is that any load-bearing headers must have the required amount of bearing down to the floor or the bottom plate, and ultimately the foundation.

For an exterior-mounted window, the outer faces of the buck framing that extend past the sheathing are wrapped with a self-adhering flashing that laps back over the wall’s exterior membrane (Images 9 through 11). Off-the-shelf products such as DuPont Tyvek® StraightFlash™ are one option. If desired, a sloped sill, i.e., a piece of beveled cedar siding, can be added on top of the box and wrapped as part of the process. This helps direct water that runs down the wall toward the front of the window and away from the vulnerable joint where the buck exits the wall. The adhesive flashing that wraps the buck is trimmed flush inside the window opening to completely seal all exposed wood. This flashing gives the flanges of the window a direct sealing surface to the self-adhering waterproofing membrane. An alternate method is to flash the window box bottom, first creating a waterproof interior sill for about the first four inches or so, then install the window, and finally wrap the flanges with the adhesive membrane.

Exterior-mounted window Pros and Cons.

The advantage to the exterior-mounted window is speed. There is just the inside sill to contend with, as the outside of the window only requires casing and flashing as finish details. This method results in significant labor savings. One disadvantage of this method is that the window is no longer on the same drainage plane as the wall sheathing. The joint where the jamb passes through the sheathing presents a weak spot for water infiltration. Another issue is that the window may stay cooler and be more prone to condensation and frosting on the inside because it is positioned on the outside of the wall. This conclusion is based on anecdotal evidence in 2x6 walls using six inches of foam board during negative forty degree cold spells in Fairbanks, Alaska. Warmer climates and shallower window wells would likely avoid this problem. Weigh both the regional climate and the level of importance placed on good weather sealing when choosing the exterior-mounted window method.

(Continued page 16)
Wall framing with optional batting insulation
Structural sheathing
Exterior membrane
Rigid foam board (2 layers staggered at all joints)
1x furring strips in line with studs, attached with screws to framing
Exterior siding
Beveled siding added to slope top (optional)
Flexible adhesive flashing
Window nail flange (caulked)
Window exterior trim
Foam backer rod
Air gap filled with expanding foam sealant
2x framing jamb extension

Interior jamb extensions
Triple pane window
Window sill
Sloped sill or beveled siding (optional)
Approved sill flashing (if applicable)
Air gap filled with expanding foam sealant
Foam backer rod
Window exterior trim
Window nail flange
No caulkling at bottom of flange for water run-off (if desired)
2x framing sill extension
Exterior membrane

Figure S. EXTERIOR-MOUNTED WINDOW
Image 8. Tyvek® DrainWrap™ is showing promise as an exterior membrane option, (as pictured here and the following pages on the CCHRC facility). It has met with code approval in areas of southeast Alaska, and its performance during sustained periods of extreme cold continues to be tested in Fairbanks.

Image 9. Window buck sill detail with Tyvek® FlexWrap™
Image 10. Exterior window buck sill corner detail. Tyvek® FlexWrap™ (or similar product) must be stapled arround edges.

Image 11. Shingle-style flashing on exterior window buck.
Exterior-mounted Windows
Summary and Installation Tips

- Best in a dry climate with infrequent wind-driven rain.

- A foam backer rod, caulked, will ensure a better, more durable seal in the space left around the window on the inside; spray foam can then be used to fill the remaining gaps.

- Have your door and window bucks sized to fit the entire depth of the wall; include the thickness of the framed wall, sheathing, foam, and furring.

- For accurate sizing of window and door bucks, measure the actual foam to be used on the project, as sometimes foam sizes vary slightly from their stated thicknesses.

- If the window buck material is not as deep as the wall, additional thickness can be achieved with furring strips, applied on the interior side of the window buck.

- Load-bearing headers must have the required amount of bearing on the trimmers in order to properly transfer any overhead loads.

- Multiple methods of flashing around the windows will work with this installation.

- Adhesive flashing is preferable to completely seal all wood on the buck. Before applying, check the product literature to make sure different flashing types are chemically compatible.
Inset windows.

In a wet climate, especially where wind-driven rain can drive bulk moisture behind the siding, a continuous drainage plain is a better option (Figure 6). One advantage of a continuous drainage plane is that the door and window openings can be framed and sheathed traditionally. The windows are attached and flashed directly over the sheathing or exterior membrane using standard flashing techniques (Image 13).

Once the wall is framed, the first step is to install the exterior membrane and requisite sill flashings. The flashings typically consist of self-adhering waterproofing membranes and an optional sill pan. If the sill and/or sill flashing are installed before the exterior membrane, the bottom edge should remain unattached to the face of the sheathing so that when the wall’s exterior membrane is installed around the window it can slide under the flashing to ensure proper drainage.

The windows are attached by nailing and caulking the flanges along the top and sides to the sheathing or the chosen exterior membrane, depending on the order of events and according to the manufacturer’s specifications. In wet climates it may be desirable to omit caulking the bottom flange and slope the sill framing so that any potential water that works its way past the window or the seals can drain back out. This method is by no means the only way to flash a window. The most important thing to be aware of is that water traveling down the wall should always run over the flashing joints, not under, using shingle-style installation methods.

Once the window is installed and the building exterior is completely weatherproofed, a pre-assembled four-sided jamb extension, sized to the finished thickness of the wall, can be fastened in place (Images 12 and 14). Since this window box sits on top of the window flanges and flashings (unlike the earlier method discussed that uses full-depth window bucks), it maintains the drainage plane of the wall. Ideally, the fasteners used to attach the jamb over the window will penetrate through the underlying self-adhering waterproofing flashing membrane. Any water that finds its way behind the jamb or the foam board will hit the drainage plane and be directed downwards via the exterior membrane. This installation method is more tolerant of wet environments. Ideally, the jamb extension will have a beveled bottom sill to direct water away from the window. A piece of beveled siding will also be nailed on top of the box and completely flashed with an adhesive membrane, i.e., Tyvek® FlexWrap™, to keep water from running down the wall and behind the extension. As an alternative to the beveled siding, the top of the window box itself can also be sloped slightly to the front (around 2-5 degrees) to insure water is directed outwards. The jamb extension itself can be built out of finish-grade materials such as cedar, synthetics such as AZEK® trim, or wrapped with a pre-bent metal trim to suit the siding (Image 15). Additionally, for those interested in synthetic stucco, this type of finish requires no jamb extension (Images 16, 17, and 18).
Wall framing with optional batting insulation

Structural sheathing

Exterior membrane

Rigid foam board (2 layers staggered at all joints)

1x furring strips in line with studs, attached with screws into framing

Exterior siding

Flexible adhesive flashing (optional)

Window top trim

3/4 inch composite jamb extension (top at 2-5 degree slope)

Window nail flange (caulked)

Foam backer rod

Attachment with 2 inch by 2 inch galvanized angle flashing

3/4 inch composite jamb extension

Triple pane window

Interior window sill

Bevel siding added to slope sill (optional)

Airgap foamed with expanding foam sealant (if applicable)

Foam backer rod

Approved sill flashing (if applicable)

3/4 inch composite jamb extension (installed before window)

Sealant

Window sill trim

Window nail flange

No caulking at bottom flange for water run-off (if desired)

Exterior membrane

Figure 6. INSET WINDOW
Image 13. Inset window with AZEK® jamb extension, attached to the sheathing using 2 inch x 2 inch light gauge galvanized flashing

Image 14. Inset window with AZEK® and first layer of foam

Image 15. Inset window with steel jamb extension

Image 16. Inset window with stucco exterior
Windows and Doors

Image 17. *Stucco preparation:* Inset window flashing

Image 18. *Stucco preparation:* fiberglass mesh for corner support is stapled to the framing and wrapped around the foam
Inset Windows
Summary and Installation Tips

- Best in a climate where moisture and wind-driven rain are frequently present.
- Allows traditional window and door framing.
- Pre-assemble your jamb extensions with beveled bottom and top sills as desired, to save time.
- Less prone to icing in very cold climates because the window is in the middle of the insulated wall where the glass stays warmer.
Overview

Self-adhering waterproofing membranes, i.e., Grace Bituthene®, were used in early REMOTE construction due to their impermeability and ability to seal around fastener penetrations (Image 19). Covering an entire house with these materials is extremely effective but typically more expensive. As an alternative, 6-mil polyethylene sheathing has been used with good results and meets Fairbanks building codes which require the use of a vapor retarder with a permeability (perm) rating of .06 or less. It is worth noting that 6 mil poly is more susceptible to physical damage during installation, and breaks down after extended exposure to sunlight. Another product that is showing promise as an exterior membrane and is particularly well suited to wet climates is Tyvek® DrainWrap™, a vapor-permeable air barrier. Exterior membrane placement is key to maintaining a well-sealed, dry home (Figure 7). As codes for exterior membranes may vary by location it is important to check to see which type can be used in a specific region. It is typical in Interior Alaska to terminate the exterior membrane at the connection with top plate of the uppermost floor, as shown in Images 20. However, in wetter regions of Alaska, such as Southeast and other coastal areas, it is best to apply an additional course of exterior membrane to cover gable ends and any other wall sections that would otherwise be left exposed. This addition doesn’t change the connection of the exterior membrane to the interior vapor retarder shown in Image 22.

Exterior Membrane

Tyvek® DrainWrap™ differs from 6-mil poly and Grace Bituthene® because it is considered vapor permeable with a perm rating of 50. In locations where Tyvek® DrainWrap™ is code-acceptable, other components in the wall system are taken into account when calculating overall vapor permeability. For example, rigid foam boards range from less than one to five perms, depending on type and density. Half-inch plywood and seven-sixteenths-inch oriented strand board (OSB) are the exterior sheathing used in the vast majority of residential construction. Due in part to the exterior glues used in their manufacture, both products also have very low perm ratings, typically less than one. When rigid foam board, and the exterior sheathing are combined in REMOTE construction, the wall system as a whole provides a very effective barrier, and air movement from inside to outside is negligible. This point is important. Air movement is the primary vehicle by which moisture travels through walls. The combination of continuous overlapping layers of exterior insulation also does an excellent job of stopping thermal conduction to the framing members. By successfully addressing the air leakage and conduction issues, the physical conditions necessary for water vapor to travel through the building envelope are greatly reduced. In addition, as is typical for all REMOTE walls, should any wetting events occur in the framing, they will readily dry to the inside of the house.

Tyvek® DrainWrap™ as the exterior membrane is popular in Southeast Alaska and meets building codes in some Alaskan cities (Image 21). Where wind-driven rain and bulk water infiltration are a primary concern, Tyvek® DrainWrap™ is a good choice because facilitates draining and the structural components of the house are protected; a self-adhering waterproofing membrane will also protect well in this climate. Tyvek® DrainWrap™ is still undergoing testing by CCHRC researchers in Fairbanks as it is a region that experiences extended periods of severe cold in winter. The product has performed without issue in the three winters since the facility was completed. It is important to note that in all tests to-date adequate indoor humidity control was present through the use of HRV systems.

As mentioned in the framing overview, window and door jambs are flashed and sealed with a self-adhering waterproofing membrane to resist the weather at critical joints. Tyvek® FlexWrap™ in particular, does a good job of providing a continuous sill flashing that can be molded to wrap up the window sides. As an extra precaution, the wrap should be stapled around the edges to help it maintain its shape over the long term, rather than relying strictly on its inherent adhesive properties alone.
Figure 7. EXTERIOR MEMBRANE INSTALLED ON FOUNDATION, WALL AND CEILING
Exterior Membrane

Image 19. Grace Bituthene® exterior membrane, one of several vapor retarder options

Image 20. 6-mil polyethylene exterior vapor retarder, note installation of foam board against wall before installation of garage gable truss. For structures outside of Interior Alaska, the exposed wall sections under the gable ends should have the exterior membrane extended to provide complete coverage.
Image 21. An exterior air barrier is optional and subject to codes

Image 22. Adhesive strip detail

Image 23. Strip lapped over top plate and sealed to interior ceiling vapor retarder and exterior membrane
The Code.

The IRC (International Residential Code) requires a vapor retarder with a perm rating of less than one perm. Local codes may be more stringent, as is the case with the Fairbanks City Building Department which has amended the IRC to require a vapor retarder with a perm rating of .06, the equivalent of 6-mil poly. Ultimately, the choice of exterior membrane material rests in the hands of the entity that will be doing the inspections and code enforcement.

Some inspectors may consider the sheathing adequate if it has a perm rating of less than one, by taking the overall type of construction into account, while others may hold the building code to the letter and require a specific exterior membrane that has a compliant perm rating (Image 20). As a case in point, Juneau, Alaska is in a maritime climate with high ambient humidity levels and cool temperatures—a typical Juneau winter will experience multiple freeze-thaw cycles. It is an extreme climate in terms of condensation potential and weather-related issues as they affect residential construction. The Juneau building code approves properly constructed REMOTE homes that use Tyvek® DrainWrap™ over exterior-rated sheathing. The REMOTE wall system is proving itself to be an excellent performer in this challenging environment.

Vapor Retarder Details.

Continuity from the interior ceiling vapor retarder (typically 6-mil poly) to the exterior wall membrane is preferred whenever possible. While continuity may not be an option in REMOTE retrofits where the roof system is already in place, it is strongly recommended that this detail be addressed in new construction. The transition from exterior membrane to interior membrane can be achieved by cutting strips of self-adhering waterproofing membrane that are wide enough to cover the double top plate and extend down both sides of the wall several inches (Images 22 and 23). On the exterior of the wall this strip laps over the exterior membrane, while on the interior, the ceiling vapor retarder extends down the wall and over the strip (Image 24). A bead of flexible sealant is used to seal the joint between the ceiling 6-mil poly and top plate strip. Any time sealant is used to join vapor retarders, this joint must have a solid backing to ensure a long-lasting seal. In this case, the edge of the double top plate provides the compressive support to ensure a positive seal. Since the upper surface of the double top plate is now covered, roof layout will have to be done with a permanent marker or other suitable means. On a building where all the double top plates are continuous, even if they change planes, a good membrane interface from interior to exterior can be achieved relatively easily with strips of adhesive membrane. Planning for easy membrane transitions from the exterior to the interior, over the walls, is easier in the design stages. One example involves scissor trusses and cathedral ceilings: rather than frame the gable wall full height, consider framing the wall so that the double top plate is in plane with the ceiling vapor retarder. Apply the membrane strip and set a gable truss or a dropped gable truss to complete the wall. Avoid piecing the vapor retarder together between stud bays and around studs. Unique issues with vapor retarder transitions tend to arise when building complicated structures.
Exterior Membrane
Summary and Installation Tips

- Check with your local building inspector before building. Permeability rating requirements in a particular location are important to consider before choosing an exterior membrane.

- Several types of exterior membranes have been shown to work successfully with REMOTE walls. These include self-adhering waterproofing membranes such as Grace Bituthene®, vapor retarder such as 6-mil polyethylene, or air barriers like Tyvek® DrainWrap™.

- It is essential in new house construction to form a continuous membrane that makes the transition from the interior ceiling to the exterior wall. This can be achieved by applying strips of adhesive membrane over the double top plate that lap several inches down either side of the wall. As the vapor retarder is now on the exterior sheathing, a vapor retarder is no longer needed on the interior wall, and should generally be avoided to prevent a “double vapor barrier” which can trap moisture in the wall.
Overview

The use of rigid foam board in the REMOTE Wall System is to supply a high R-value in a practical thickness and to move the dew point from the stud bays to the exterior side of the sheathing. Both expanded polystyrene (EPS) and extruded polystyrene (XPS) lend themselves very well to the REMOTE system (Images 25 through 27). Polyisocyanurate (polyiso) is widely used for exterior insulation across the U.S., but hasn’t typically been used in the REMOTE system in Alaska.

Exterior Insulation Choice

There are a few things to consider when selecting rigid foam board for use in a REMOTE wall:

- If the wall will be coated in stucco, then the stucco manufacturer will have specifications on sheet sizes, foam board types, and fastening methods.
- In wall systems that will receive furring there are more options. Either EPS, XPS, and polyiso can be used.

There are some differences in the products that are worth noting. Unfaced EPS has water vapor permeability ratings of between two and five perms per inch of thickness, and the foam board weight ranges from one to two pounds per cubic foot. Facings applied to EPS, such as the InsulFoam® R-tech® product line, can reduce the perm rating to less than one. The facer becomes the limiting factor in determining the insulation water vapor permeability. There is some question about how facings might affect moisture shedding in maritime climates and whether water can become trapped between smooth-facing surfaces. As a result, in a climate with consistently high ambient humidity levels and driving rain issues, an unfaced EPS may be a better choice (it is sometimes possible to peel the facers from the foam board if necessary). In Fairbanks, Alaska, the R-Tech®-faced foam boards have been used with good results. XPS foam board has a perm rating of a little over one perm per inch thickness. This rating is inherent to the foam board, as XPS is not typically manufactured with facers. In all cases, the individual layers of foam board should overlap at all seams and be staggered at the building corners to further limit any air flow through the wall. Gaps between the sheets should be filled with minimally-expanding spray foam.

Both EPS and XPS foam board have performed very well in tests of the wall system conducted in Southeast Alaska. Although some foams contain a borate additive to resist insect damage, this treatment may be subject to leaching over time in wet climates, particularly below grade. In situations where insect damage poses a significant threat, borate treatment as part of a comprehensive approach to pest management will provide the best preventative measures.

Polyiso foam board is typically manufactured with aluminum foil facers, which make this insulation highly water vapor impermeable (less than 0.1 perm). If unfaced, polyiso has a similar permeability to EPS. Polyiso is not intended for below grade applications. However, polyiso should be an acceptable choice in above-grade applications if properly protected from water. In fact it is an attractive choice from the perspective of achieving a target R-value while keeping the insulation thickness practical due to it’s high R-value.


Other exterior insulation types for REMOTE have been used or experimented with over the past several years, although experience in Alaska is still relatively limited. One new option is rigid mineral wool insulation, such as Roxul® COMFORTBOARD™. This product is similar to foam board in terms of installation, but is much more water vapor permeable or “vapor open,” allowing for different moisture control designs than currently available with foam insulation. Other insulation options that have been pursued in Alaska include spray applied polyurethane foam and loose-fill insulation. These applications have good potential for use in the REMOTE system, but require
different construction techniques for application and mechanical fastening of siding. These topics will be addressed in future revisions of the REMOTE manual.

**Foam board Thickness.**

Multiple layers totaling four inches, six inches, or greater are currently the most common foam board thicknesses used in REMOTE wall construction. To ensure that the envelope provides adequate moisture control, the amount of exterior insulation is guided by the local climate, as discussed later in the manual. Additionally, an energy model based on plans can be a useful tool to help gauge paybacks for a region’s climate and energy costs.

**Where Wall Meets Foundation.**

How far the wall foam board extends over the foundation is discretionary and case dependent. The main issue is that the wall and rim joist faces be framed and sheathed so that the desired layer of foam board can make a smooth transition down over the foundation exterior. Avoid having a jog between the two faces where a non-standard thickness of foam board would be required to bring the walls into plane. If the foam board does not extend all the way down to the footing, but to just below grade, a non-frost susceptible backfill may be needed to prevent seasonal ground movement from lifting the overhanging edge.

**Insulation Ratios by Climate.**

Using the REMOTE wall system, a broad range of total wall R-values can be achieved, however, the balance of the interior stud cavity R-value to the exterior foam board R-value is an important moisture control consideration that will vary by climate. Achieving an appropriate balance of exterior and interior insulation is a very important factor in building a durable structure. If the balance is off, it can lead to moisture problems by allowing the framing to reach dangerously high humidity levels or allow condensation in the wall assembly. One of the most important variables in determining appropriate insulation ratios is climate. In general, the colder the climate region, the more the insulation balance needs to move to the exterior.

In conjunction with the exterior foam board, 30% to 50% of the total wall R-value can be added to interior stud cavities. While this is typically in the form of fiberglass batting, other common cavity fill insulation such as blown-in fiberglass or dense pack cellulose are good choices too. In Fairbanks, keeping this ratio around the one-third to two-thirds “rule of thumb” approach is a safe design that will prevent water vapor from condensing inside the wall framing. In contrast, Anchorage and Juneau can approach 40% to 50% of the total wall R-value in the stud cavity, whereas in Barrow the study cavity R-value should not exceed 30% of the total wall R-value.

**FIGURE 8. INSULATION RATIOS BY CLIMATE**

<table>
<thead>
<tr>
<th>AHFC BEES Climate Zone</th>
<th>Representative city</th>
<th>Maximum % of wall R-value in interior (stud cavity)</th>
<th>Minimum % of wall R-value on exterior (over sheathing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Juneau</td>
<td>57%</td>
<td>43%</td>
</tr>
<tr>
<td>7</td>
<td>Anchorage</td>
<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>8</td>
<td>Fairbanks</td>
<td>33%</td>
<td>67%</td>
</tr>
<tr>
<td>9</td>
<td>Barrow</td>
<td>28%</td>
<td>72%</td>
</tr>
</tbody>
</table>

Examples of construction practices that meet or exceed the above standards:

- In Juneau—4 inches of XPS or EPS on a 2x6 wall with maximum R-13 in stud bays
- In Anchorage—4 inches of XPS or EPS on a 2x4 wall with R-11 in stud bays
- In Fairbanks—6 inches of EPS on a 2x4 wall with R-11 or R-13 in stud bays

A REMOTE wall system with R-value distributions not in line with the percentages above will be less accepting of moisture. In these situations, once damaging moisture levels are attained in a wall cavity, tests indicate that the presence of stud cavity insulation will significantly slow the wall’s drying time. Regions of Alaska north of Fairbanks can add a layer of conservatism by reducing the warm-side insulation to less than 30% of the total, or may even be best served by omitting warm-side insulation entirely. Equally important are educated occupants. Homeowners who understand how to operate the home and manage humidity will greatly affect how the wall system performs.
**Case Study**

REMOTE Wall Testing in Fairbanks.

CCHRC has been testing local climate limits by pushing beyond the one-third “rule of thumb” warm-side insulation ratio. The north wall of the office portion of the CCHRC Research and Testing Facility was built with six inches of EPS foam board and R-19 fiberglass batting in the stud bays, resulting in a total nominal wall R-value of approximately R-45. This exterior-to-interior insulation ratio is 58% to 42%, which places more insulation on the warm side than the guidelines in Figure 8. In three winters of testing, the wall section containing 42% warm-side insulation has only reached the dew point on one occasion. This spike in humidity was not sustained beyond the cold spell, and the elevated moisture levels disappeared once outside temperatures rose. Other walls in the facility have been insulated to R-13 in the stud bays and with six inches of EPS, which is in keeping with the guidelines in Figure 9. These walls have never come closer than 20 degrees to the dew point and have proven to be very safe performers.

Because CCHRC’s Research and Testing Facility has mechanical ventilation, the interior humidity levels in the winter are quite low, often well under 20% relative humidity. This helps reduce the risk of reaching the dew point within the wall framing. However, home ventilation in cold climates has been a long-standing challenge and many homes lack sufficient air exchange. Furthermore some homeowners choose to humidify because of the dry winter air. Therefore it’s not unusual for homes to have substantially higher interior relative humidity. To examine these conditions, CCHRC studied several REMOTE test wall constructions with different exterior and stud cavity insulation ratios. Lab conditions were maintained at 40% relative humidity for one winter, and 25% for the next. After two years, the test walls that didn’t keep within the guidelines in Figure 8 had abundant mold growth on the plywood sheathing and high wood framing moisture contents, whereas test walls that had insulation distributions consistent with Figure 9 had no visible mold and kept the framing moisture content well out of the risk zone.

There is some concern that if the fiberglass insulation does not completely fill the stud cavity, convective heat losses may reduce the effective R-value of the insulation in this area. One of the test walls at the CCHRC facility used R-13 fiberglass batting in the 2x6 stud bays, leaving approximately two inches of air space between the back of the drywall and the insulation. During the five coldest months of the 2008-2009 winter, the insulation value of the wall cavity (including the air space and the fiberglass) averaged a value of R-7, lending some weight to this concern. This drop in R-value was determined using calculations based on the known R-values of the insulation used in that wall section, in combination with the temperature recordings from the sensor string in the wall. Further study is warranted as no temperature sensors were located in either the fiberglass or the air space, and this wall was not set up to test for this phenomenon. Given all the variables involved, it is not possible to draw conclusions at this point.

**Future testing.**

As of early 2013, CCHRC is conducting testing to investigate differences in moisture control for the REMOTE system between water vapor permeable house wraps (e.g. Tyvek® DrainWrap™) and vapor impermeable membranes (such as Grace Vycor®) as the exterior membrane. See the discussion on page 21 for more background. Also included in this testing are different types of insulation, such as cellulose in the stud cavity and the exterior insulation. These tests are being conducted at ASHRAE design standards of 70 degrees F and 40% humidity for the interior conditions.
Insulation

Image 25. Foam board is loosely attached to framing with a four inch sheetrock screw and a Wind-Lock® plastic washer

Image 26. Second layer of foam board is loosely attached using transferred stud pattern with eight inch screws and Wind-Lock® washers
Insulation

Bays and Cantilevers.
The REMOTE system lends itself well to some areas that are difficult to insulate and seal properly using conventional methods. Any places where floors extend beyond walls and are exposed to the outside can be notoriously difficult to seal. The exterior foam and barrier membrane can be relatively easily cut to follow these types of projections, thereby effectively bringing them into the conditioned space of the building (Images 27 through 29). Keep in mind that any window layout in a bump-out is subject to change as the extra wall thickness produced by the foam generally moves openings further away from the corners.

Image 27. Close-up of a square cantilever bay window with attached foam board

Image 28. Foam board covering a curved cantilever

Image 29. Cantilevered addition wrapped with foam board
Insulation
Summary and Installation Tips

- A one-third interior to two-thirds exterior insulation ratio is considered safe in climates with 14,000 Heating Degree Days (such as Fairbanks) or less.

- The key to the REMOTE Wall System is moving the dew point in the wall to the cold side of the wall (exterior).

- Both expanded polystyrene (EPS) and extruded polystyrene (XPS) can be used in the REMOTE system.

- To make installation most efficient, be sure the first layer of foam-board insulation is applied straight and level.

- It may be helpful to transfer the stud locations on to the successive layers of foam board. The foam board only needs to be held in place well enough to stay aligned and resist winds until the furring is attached.

- To ensure continuous insulation, stagger seams between each layer so each seam is covered by solid foam board in the subsequent layer; transfer the stud location pattern to this layer. Continue this pattern for any additional layers.

- Stagger seams on corners.

- Fill gaps and damaged spots between the sheets with minimal expanding foam.

- Four inches of rigid foam board is the minimum recommended in cold climates; six inches yields higher performance in Interior Alaska.
• Wall and floor framing should be located on the foundation so that the exterior foam board can transition smoothly all the way down to the footer in one plane, without steps or jogs. Avoid having foundation wall offsets that will require non-standard thickness of foam board to make the transition.

• If foam board insulation does not extend to the footing, consider frost-resistant backfill to prevent the foam board edges from lifting.

• If not using furring strips when attaching the final layer of foam board, use large plastic washers and screws at least one inch longer than the total thickness of all foam board layers.

• Foil-faced foam board may not be suitable for climates where wind-driven rain can cause water to be trapped between the layers. Unfaced foam board provide better drainage and drying properties.

• Some foam board, such as Insulfoam® R-Tech®, can be special-ordered in three-inch thicknesses, which will speed up construction in walls using six inches of exterior foam. Note the limitations of your saw blades when ordering foam.

Bays and Cantilevers
Summary and Installation Tips

• In the REMOTE Wall System it is easy to apply exterior membranes and insulation to cantilevers.

• Extra insulation added to the floors of cantilevers is subject to the same one third warm-side R-value ratio as the walls.
Overview

In most situations, the wall furring provides the bulk of the structural attachment for both the foam board and the siding. The foam board layers can be loosely attached using a variety of methods: framing staples, nails, and washer-head fasteners can all work for the initial attachment. Keep in mind that the foam board should be attached well enough to resist winds until the furring can be applied. Lighter densities of foam board may require more care during furring installation because they may compress more readily if the fasteners are overdriven, especially around openings.

In the field 1x4 dimensional lumber and wider three-quarter-inch plywood corners are typically used for furring. The plywood should extend far enough in both directions to allow positive attachment into the corner framing as well as be able to provide surface area for the desired width of corner trim and siding terminations (Images 30 through 36). In wet climates, venting the spaces between the furring strips at the top and bottom, and around windows and doors, is an option. Good air flow behind the siding will help with drying by providing an exit path for any moisture that makes its way past the siding. Image 36 shows a furring pattern appropriate for wet climates.

Structural Screws.

The standard fastener for attaching furring is a pan-head panel-type roofing screw that is long enough to pass through all layers of foam board and penetrate securely into the framing. As a rule, all furring that supports siding should be fastened to the wall framing members (Figure 9). Most screws of this type will have a reasonable corrosion resistance, but if they will be used below grade, in treated wood, or in an extreme environment, it may be necessary to consult the manufacturer. An impact driver often makes for much easier installation. Screw head profiles range from #3 Phillips, Torx, Star, and Square drive among others, to make for more positive driving. Screws should penetrate through the sheathing and a minimum of 1.25 inches into the studs. Longer screws are available, including half sizes in some brands, if significant upsizing is desired.

With 2x4 walls in particular, keep in mind that errant fastener penetrations can run the risk of damaging wiring or plumbing runs in the exterior walls. Vertical fastener spacing can vary from one to two feet on center, depending on the siding and wind loads. Driving the screws in at a slight upward angle, such as 0.5 inch in six inches is highly recommended as it creates a mechanical advantage that significantly increases the bearing capacity of the assembly (Figure 9). In addition, a truss clip can be attached to any rafter tails that line up with the furring. In any situations where excessive structural, seismic, or wind loads are an issue, it is recommended that an engineer be consulted to verify that the construction methods are appropriate to the conditions. Metal fasteners are very conductive and any long screws that penetrate from the exterior to the interior can present a condensation point. In these cases, a scrap of foam board big enough to cover the exposed portion of the screw can be pushed on the screw tip and sealed to the sheathing with spray foam.

![Figure 9. SCREW PLACEMENT AND ANGLE](image-url)
**ATTACHMENT INFORMATION**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<tr>
<td>Vertical Load capacity of loaded screw from ESR4078</td>
<td>.187 inch</td>
</tr>
<tr>
<td>Oly Log/Timber Lok screw load capacity</td>
<td>136 lb/width</td>
</tr>
<tr>
<td>(136 lb/6 inch)(0.5 inch)= Shear= 11.3 lb</td>
<td></td>
</tr>
<tr>
<td>Hardie Plank</td>
<td></td>
</tr>
<tr>
<td>11.3 lb/(2 ft x 2.3 psf) = 2.5ft = 29 inch</td>
<td>Install screws 24 in O.C.*</td>
</tr>
<tr>
<td>Wood and vinyl siding</td>
<td></td>
</tr>
<tr>
<td>Install screws per manufacturers specifications</td>
<td>Typically 24 in O.C.</td>
</tr>
</tbody>
</table>

**SIDING WEIGHTS**

<table>
<thead>
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<th>Material</th>
<th>Weight (psf)</th>
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<tbody>
<tr>
<td>Hardie Plank</td>
<td>2.3</td>
</tr>
<tr>
<td>Wood: 7/16 inch OSB</td>
<td>1.3</td>
</tr>
<tr>
<td>Vinyl</td>
<td>0.5</td>
</tr>
</tbody>
</table>

* O.C. - on center

Figure 10. FURRING AND SIDING DIMENSIONS, WEIGHTS AND ATTACHMENT DETAIL
Image 30. Pre-drilled furring speeds installation process and keeps fasteners at a consistent height to avoid conflict with interior mechanical runs through the stud bays.

Image 31. Exposed fasteners inside the wall must be covered to prevent condensation.
Furring and Siding

Image 32. Vinyl siding in progress, note furring around chimney support

Image 33. Furring wraps around the window buck edges so the window can seal directly to the membrane on the buck. In wet climates, spaces above and below windows, and above doors, should be vented.

Image 34. Detail of wider furring on corner, allows for fastening to corner framing.
Furring and Siding

Image 35. Vinyl siding in progress. Note that all spaces between furring strips are vented rather than capped.

Image 36. REMOTE home with multiple exterior finishes
Furring and Siding
Summary and Installation Tips

- 1x4s are a good choice for furring strips; treated wood may be a better choice in wet climates.

- Be sure the corner furring is wide enough to allow fastening to the corner framing and to attach siding.

- Check with your local dealer in advance about the fasteners you will require to make sure they have them in stock.

- Screws to hold furring strips should be driven 1.25 inches into the studs, not counting the sheathing.

- Screws should be driven at a slight upward angle (0.5 inch vertical rise for every 6 inches horizontal, from front to back) to increase their bearing capacity.

- The vertical fastener layout for attaching furring strips is usually 24 inches on-center but consider the siding that will be used before attaching the furring.

- Any metal fasteners that can conduct cold and are exposed on the inside of the wall should be covered with some type of foam insulation to prevent condensation.

- If furring will be attached before mechanical systems are run in the exterior walls, consistent heights in the layout pattern for screws will minimize any interference or damage, particularly in 2x4 walls.

- Be sure to let the plumbing and electrical subs know at what height increments the furring fasteners are located so they can drill their holes through the studs without damaging their tools or the screws themselves.
Ventilation.
Due to the nature of their construction, homes built using the REMOTE Wall System are very tight and will require an external source of fresh air. Exhaust-only systems with passive fresh air intake vents and HRVs are both viable options.

Retrofits.
As an energy retrofit measure, the REMOTE system lends itself especially well to relatively straightforward home construction with wall planes that have minimal obstructions such as bump-out bays, multi-story decks, and other attached exterior structures. Sometimes the complexities involved in achieving good exterior barrier continuity, flashing details, and proper insulation thicknesses are simply not viable for REMOTE, or are prohibitively expensive. Homes being considered for a REMOTE retrofit need to be decided on a case-by-case basis. Fortunately many older homes and subdivisions used simpler construction methods and make good candidates, particularly those with T1-11 siding.

Another point to consider is that most Alaska retrofits will have existing interior vapor retarders, which creates a “double vapor barrier” situation that is unavoidable for practical reasons. That means vapor that migrates through holes in the vapor retarder can be trapped in the wall, as exterior foam blocks the drying path to the outside. The positive side to this situation is that if the proper inside-to-exterior insulation ratio is maintained, and the exterior membrane and flashings are detailed correctly, CCHRC research has shown that this “double vapor barrier” effect should not be a problem. While the presence of an interior vapor retarder will significantly slow drying to the inside, having the proper amount of outside insulation has been shown to be a more significant moisture control element in Interior Alaska. These findings should translate to other climate regions of Alaska, assuming that potential exterior wetting mechanisms have been addressed in the retrofit. In all circumstances, a mechanical air exchange system is necessary for an older home that has undergone a retrofit. Mechanical ventilation will help ensure adequate moisture control and a source of fresh air, both of which are critical to occupant health and building longevity.

New construction.
There are many possibilities for new construction. What matters most is that the concepts and principles presented here are taken into account during the planning stages. This will help to make informed decisions that will contribute to overall labor savings and energy performance. As an example, exterior transitions such as cantilevers and large bay windows can be time-consuming to seal and insulate properly. The REMOTE system simplifies the detailing in these areas by attending to them on the exterior where they can be readily incorporated into the continuous thermal envelope provided by the rigid foam board.

One of the biggest hurdles to widespread use of the REMOTE Wall System is a lack of trained crews and contractors familiar with the construction processes. This is changing. For example, the U.S. Army is adopting the REMOTE system for hundreds of new homes designed to meet military housing needs in Interior Alaska. The system is being embraced more readily as perceptions in the home construction industry are changing. Energy efficiency and a longer-term view of home ownership are driving forces that help make REMOTE construction a viable—and attractive—option.
Conclusion

To ensure that you have the tightest building envelope possible, consider conducting a blower door test. The best time to do this is when the foam board, exterior membrane, ceiling vapor barrier, windows and doors are all in place and the ceiling has been sheetrocked. Ideally any plumbing and wiring penetrations will also be in place. At this point, the blower door test provides a good diagnostic tool for determining the specific locations of air leaks when they can be easily identified and remedied.

Ultimately, the overall performance of the REMOTE Wall System is dependent on two main factors in the construction phase: the materials used and the attention to detail given during assembly. To date, all walls that have been tested by CCHRC have used an exterior sheathing—either 0.5 inch C-D Exposure 1 plywood or seven-sixteenths OSB. This line of reasoning stems from the fact that the vast majority of residential structures use these products to meet building codes. To date, no testing has been done on walls without exterior sheathing in combination with an air retarder in place of a vapor retarder. Doing so would place the exterior foam board in the role of the sheathing by exposing it directly to the warm-side environment. It is an entirely different product and its performance under these conditions is unknown.

CCHRC staff continues to research various aspects of the REMOTE Wall System and hopes to make the shift to a new construction process as easy as possible for builders. In addition to this manual, other materials about this process are available, including a DVD, cross-sectional drawings, and pictures of some of the more unusual situations that may arise due to the diverse nature of home construction. We welcome your comments on this process and other construction challenges unique to the cold climate environment.

Image 37. Completed 6,800-square-foot custom home using six-inch REMOTE walls
How to Build the Typical REMOTE Wall

1. Frame and sheathe exterior walls.
2. Apply exterior membrane, i.e., self-adhering waterproofing membrane, 6-mil poly, or Tyvek® DrainWrap™
3. Exterior-mounted or inset windows
   a. Exterior-mounted Windows
      i. install full-depth window bucks and flash to meet climate conditions
      ii. Install windows over flashed buck framing and flash nail flanges
   b. Inset Windows
      i. install windows and flash to meet climate conditions
      ii. Build and install exterior jamb extensions over windows
4. Doors – Build and install door sills and flash openings as required
5. Install deck blocking or other exterior blocking as required (i.e., hose bibs, electrical, vents, etc.)
6. Install overlapping layers of foam board until desired insulation thickness is reached, using the warm-side ratio calculation
7. Install vertical furring over studs and corners to support siding.

*Note: Screws used for furring attachment must penetrate framing to support structural loads and avoid condensation points in wall. Furring can be pre-drilled on layout before installing to speed process*

8. Install exterior window furring to support finished window trim
9. Install desired siding and exterior trim
10. Inspect and seal any interior fastener penetrations, paying special attention to any metal connectors that can conduct cold to the inside and pose condensation problems.
“Promoting and advancing the development of healthy, durable, and sustainable shelter for Alaskans and other Circumpolar people”